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CALIFORNIA EARTH CORPS
San Diego Office
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May 19, 2003

U. S. Department of the Interior
Environmental Protective Agency
Pacific SW Regional Office
75 Hawthorne Street
Attn.: Keith Takata, Director (SFD-1)
San Francisco, CA 94105

Re: Request for Review of EPA's Decision not to Include the former Mission Bay Toxic Waste Dump and co-located Solid Waste Facility on the Superfund List, and Transmittal of Information regarding a Clear and Present Danger at the Site.

Dear Director Takata:

PURPOSE

The California Earth Corps requests that your Office revisit your toxic risk twice-revised assessment given to the site of the previous Mission Bay Toxic Waste Dump and the co-located, former Solid Waste Dump in Mission Bay (State) Park. We believe a clear understanding of the history of the area, the protocols of previous studies, and the recent investigations into the subsurface soil will indicate an immediate need to add the site to the National Priority List.

INTRODUCTION

We urgently request that your Office immediately review the just released "Results of Soil Vapor Assessment SeaWorld Expansion Plan, 16-Acre Tracts" as prepared by IT Corporation for SeaWorld in January 2002. (Enclosed at #1)

This study has been withheld from not only the public domain, but also the Technical Advisory Committee on the Mission Bay Landfill. As a member of the Committee, it appears to the Corps that this is only the latest in a fifty year campaign of obfuscation by the City of San Diego on this public safety issue. The City of San Diego is the trustee of the entire Mission Bay State Park. It gained control of the Park from the State of California which, in turn, acquired the land from the Army Corps of Engineers in 1946. The Federal Government, either in the form of the Uniformed Services or its contractors, deposited hazardous waste material in the Park. In 1952-1959, this practice continued, under the supervision of the city at its formerly established Mission Bay Toxic Waste Dump (class 1).

We believe that the EPA now has more of a role in this matter than assuring regulatory compliance with of Federal Laws. The EPA may need to act as the lead agency in the investigation of subsoils, water, and air and the remediation of the three-dimensional area contaminated by the Federal Government. This is a key issue, **as we believe the City is now attempting to literally sweep this issue "under the carpet" or asphalt of a parking lot! By the continuing lease the real estate and granting construction permits for buildout of the area with high-rise structures.**

BACKGROUND

With respect to your Office's assessment and study of this site, we understand that the initial point score (CERCLIS identification number CAD980881353) awarded the site by the Federal EPA was 61.61 in 1990. This Hazard Ranking System (HRS) score, equal to the infamous Stringfellow Dump in Riverside, CA., solidly implied eligibility for the National Priorities List (NPL). Shortly thereafter, a second LSI Prioritization Criteria report was issued. In it the HRS score of 61.61 received justification, and several additional factors were addressed. Under the "Target Population" heading, it was noted that 243,000 people live within four miles of the site. In addition, several nearby endangered species and sensitive environments were identified. When inexplicably rescoring the site in 1991, the EPA revised the point value to 49.06. Nevertheless the revised score warranted listing on the NPL. A second restoring occurred (for reasons unknown) in which the findings were further reduced to 14.01 in 1993. The entity performing the third series of tests elected not to include entire pathways of exposure. This election resulted undoubtedly in lower scores, but also made comparisons with the two earlier tests impossible.

The California Earth Corps is very uncomfortable with the unexplained course of retesting. We challenge the purpose or the need for the testing as well as the findings. We suspect that the City or one of its contractors provided flawed data to the EPA for its evaluation. Now comes a recent revelation that a scientifically **documented lethal level of hydrogen sulfide (H₂S), within ten feet of the parking lot surface in the SeaWorld guest parking area**, has been found. We are appalled that this danger emanating from the toxic waste /solid waste site exists. We are outraged that the finding was made more than fourteen months ago, but the information has not been released by the city and SeaWorld or acted upon, to our knowledge.

We must rely on the EPA to assure a standard of scientific integrity. It is our experience that the City of San Diego and its leasees have historically downplayed the potential risks of any contamination. In fact, the City chooses to call the site a former solid waste landfill, while completely ignoring wide toxic dispersal.

While we do not know the test protocol or if even the same criteria were used each time, we are perplexed by the quantum change in scores. We are unaware of any remediating in the last fifty-five years. We request you provide to us any documentation which would clarify the situation. Please inform us as to the rationale behind your scoring and revisions. We are specifically interested in learning if the EPA did the tests, your contractor did the tests, or if the city provided the test data for each HRS evaluation. Similarly with the identify of the laboratory performing the scientific analyses and the basis for interpretation of the data.

We are hopeful that the alarming revelation that a lethal concentration of hydrogen sulfide gas (H₂S) is present in this public park will prompt the Federal EPA to revisit its findings, with an eye toward reaffirming its initial site risk assessment score of 61.61 and listing the site on the NPL. In addition, we hope that your Office call the City of San Diego to task to explain its apparent neglect to monitor the site and act responsibility when new evidence of dangerous contamination is documented.

The San Diego City Council has recently appointed one of our staff to the Technical Advisory Committee(TAC) on the Mission Bay Landfill. So as not to replicate work, but in order to proceed authoritatively, with foreknowledge, we request that your Office affirm our understanding and provide us with documents which attest to your Office's previous involvement with assessment of the landfill.

We need to know where, how, and for what the Federal EPA tested for contamination, in order to assure ourselves that we know the risks to the public. We must remember that this area is a State Park which is designed and exists solely for the recreational enjoyment of the public. The delayed disclosure by the City of San Diego of the IT Corporation study prepared for SeaWorld is a development which has made us apprehensive about both park goers and the ongoing expansion activities of SeaWorld. As we write this letter, excavation and evacuation of soil, incidental to construction of a roller coaster is ongoing, in the potentially contaminated area. No remediating of any soil *in situ* or removed, is contemplated by the City.

CALL TO ACTION

We believe the body of information known, unknown, and known but not disclosed, to all parties-in-interest to include health & safety regulators, is insufficient to assure public safety during construction activities. SeaWorld has permits to construct high-rise fourteen structures and plans on building a convention center and hotel. It is not inconceivable that continuous construction will occur throughout the next ten years. This is the eighth expansion of SeaWorld.

We further believe time is of essence. We would regret, but not be surprised if a lethal release of gases and other contaminate occurred at any moment. (In 1989, a hydrogen sulfide gas release during construction of the South Shores boat launch area resulted in eight hospitalizations and one fatality. Another concentration of the same gas has now been found within the same vicinity.)

Finally, we are very concerned that site toxins are leeching into the impaired water bodies of the adjacent San Diego River and Mission Bay Estuary, Famosa Slough, and the Pacific Ocean. Recently, fish have been found with sores and other genetic deformities.

ROLE OF THE FEDERAL GOVERNMENT

We believe the Federal Government retains sole regulatory jurisdiction over the site near the recent finding of 1,820 ppm of H₂S. The Federal Government with the Department of the Interior's Environmental Protection Agency (EPA) as the lead entity. We strongly believe that this site is within a Super Fund eligible area.

We are convinced that the toxics are migrating. We do not know, but we suspect that the toxins are entered the Pacific Ocean. Only additional tests will show conclusively the degree each of those phenomenon are occurring.

We are differentiating between the Mission Bay Solid Landfill, (Classes II & III), and the Toxic Waste Dump Site, (Class I). City documents and testimony continuously merge these sites and obscure the important distinction between these closed, but active emitters. The sad fact of the matter is no one knows for sure the exact boundaries of the approved dumping area or the locations of clandestine, illegal dumping. The long-standing record reveals that dumping of toxic wastes was indiscriminate from 1952-1959 throughout the South Shores area of the State Park. Absence of records of another Class I site makes it likely that high quantity dumping here also occurred throughout W.W.II and the postwar years, sourced by nearby aerospace industry plants.

Further, not only were the toxic wastes deposited at the site from 1952-1959 by local defense contractors, agents of the federal Government, but also the US military and "other Government Agencies" openly and lawfully deposited liquid and solid wastes in an unfenced, unmarked, unmanaged open space. We must be mindful that during this period the military developed and deployed within San Diego County nuclear propulsion for surface and subsurface vessels and that the Army developed nuclear antiaircraft air defense missiles. Also the local defense contractors in San Diego were prime contractors in the design, testing, and production of these items for the entire Department of Defense. The majority of these contractors were located within one mile from the Mission Bay (class I) dump site!

We prefer to focus your initial investigations or concerns on the SeaWorld Leasehold and the adjacent parcel. Nevertheless, near the general vicinity of the proposed parking lot (e.g. along the railroad line, east of Highway I-5, near the San Diego River, approximately 1/2 mile away) was a likely, yet unauthorized, depository area. (Refer to test results from test well MW-1 that shows numerous toxins near residential Bay Park). We have established the closing date of the toxic waste dump as 12/07/59, the opening date of the South Miramar dump site.

INVOLVEMENT OF DEFENSE CONTRACTORS

Major defense contractors that used the toxic waste dump included, but were not limited to: Rohr Aircraft Corp., Ryan Aeronautical Co. later known as Ryan Industries, Consolidated Vultee, Convair, and Solar. These firms also hired contractors to haul the hazardous materials. Additionally, the navy aircraft overhaul depot at NAS North Island and the Fleet aircraft activities at NAS Miramar may well have contributed toxic substances to this site.

ROLE OF THE STATE OF CALIFORNIA

Therefore, it is inappropriate for the California Coastal Commission or other State regulatory bodies to proceed when a federal regulatory body is charged under the United States Code and the Code of Federal Regulations with supervising the remediating of this toxic area.

We are also cognizant that only after the Army Corps of Engineers completed major flood control project for the San Diego River in 1945 that the State was given title of the area in 1946. We believe Federal involvement in the continued monitoring and evaluation of the toxic wastes deposited prior to that date by Federal agencies or their instrumentality is appropriate.

ROLE OF THE CITY OF SAN DIEGO

The City of San Diego is currently undertaking a site assessment study. On 04/25/03, a representative of the local Sierra Club chapter was installed as a member of the city's Technical Advisory Committee on the Mission Bay (State) Park Landfill. Work to define the nature and extent of the landfill and toxic waste dump continues.

ROLE OF THE CALIFORNIA EARTH CORPS

A. The Earth Corps has original research on this matter. It has documentary evidence that:

- (1) the inventory of the Mission Bay Park Class I Toxic Industrial Waste Dump site was 5,000,000+ gallons, not 737,000 gallons, as stated by staff and the city, indiscriminately dumped in the immediate permit area as evidenced by test well LE-1, and monitoring wells MW-23, MW-24, and MW-25.

DOCUMENTED LETHAL CONCENTRATION

We wish to bring to your attention a disturbing, recent development with regard to the subsurface chemical activity in the area. **The enclosed study reflects that in one test well (J-24) in the SeaWorld guest parking lot, a concentration of over 1,800 ppm of hydrogen sulfide (H₂S) was found within the past fourteen months. As this poses a significant potential lethal hazard to public health and safety, we have recently reported this disturbing finding to your colleagues in the State of California's Toxic Substances Control Office.** (Refer to enclosure #2) We intend to make a report of this finding to the Air Pollution Control District, County of San Diego within the next few days.

We believe that the unknown information is far greater than the documented information. Our affiliates in the environmental movement have been researching for more than four years to patch together even this preliminary understanding of the site and its use from 1939 to present.

There are two waste facilities at issue: an industrial toxic waste dump and a solid waste landfill. Some portion of both are superimposed. We wish to direct your attention to a recapitulation of substances reported in a 1983 site assessment performed for EPA Priority Pollutants. (Refer to enclosure #3). The value of this document is twofold; (1) it lists the toxic chemicals and carcinogens, and (2) it dramatically illustrates the stratified nature of the site. This is particularly important to notice as we have disturbing trends in subsequent tests. The city and its leasee continue to perform less frequent testing, shallower testing, and more restricted testing. In one instance, a magnetometer was used to locate buried metal objects. Drilling then proceeded away from the metal so as to avoid discovery of contaminants and any necessary remediating. We believe it is time for the City to confront the poisons at this area and for remediating to begin.

DISPOSITION OF BURIED HAZARD MATERIALS

The historical record shows that neither the Toxic Waste Dump, nor landfill was fenced. The toxic dump's footprint is believed to be over a vast area, within a location known as South Shores, or currently the SeaWorld leasehold, and isolated places east of Highway I-5. **The areas where thousands of 55-gallon drums of hazardous waste were buried beneath the water table (in 1952 through 1959) remains largely undetermined;** the area where the remainder two thirds of all waste was deposited by surface or trench dumping is much larger. (Refer to area maps enclosure #4a,b,c,d,e.). We caution: **In our view, it would be a gross error to rely on maps of the soil waste dump furnished by the City and represented to be the sole site of potential contamination.** In our dealings with the City, the current regime seems intent on limiting investigation or discussion to that area encompassed by an area map labeled, "approximate limits of landfill."

We must be mindful that the toxic dumping in W.W.II & the Cold War (1952-1959) was unrestricted, and continuous, seven days weekly, 24-hour each day.

(2) the level of toxicity is such that a total of 86 site EPA -regulated pollutants has been identified—including heavy metals, industrial solvents, volatile organic chemicals, pcbs, and pesticides.

(3) three of the six test wells used in the 1983 WCC study were mysteriously vandalized prior to the 2001 study. This illegal conduct resulted in their not being available for subsequent scientific sampling so as to remove 50% of the test wells from the study. This ultimately precluded meaningful historical comparative trend analysis. Note: The Corps recommends that these wells be rehabilitated and used in future comparative testing and sampling

(4) other site risk and liability issues are posed by known presence of methane and hydrogen sulfide gases. By a just-concluded study of soil gas, shallow probe testing in close proximity to the permit site, conducted by the city of San Diego, Solid Waste Local Enforcement Agency, (Environmental Health), a concentration of methane gas at the 10% level was recorded.

Note 1: Levels of 5% are considered potentially explosive!

Note 2: This test result was announced at the Technical Advisory Committee (TAC) of the Mission Bay Landfill as co-chaired by Council persons D. Frye & M. Zucchet.

(5) in the Fluor Daniel GTI assessment report, dated 06/09/97, of the SeaWorld Lease Expansion, it was reported that well (LE-1), near the proposed parking lot site, registered the presence of 1,1,1-trichloroethane. In fact, five of six wells indicated a plume of trichloroethane the study attributed to former aerospace activity: "The chemical compound is widely used as a solvent in the aerospace industry. The contaminant appears to be widely dispersed in a relative uniform concentration, consistent with dated landfill disposal of barrels in a corrosive environment."

The same dewatering operation for the Wild Arctic Project is now occurring with the Splashdown Thrill Ride, a.k.a. Roller Coaster. SeaWorld's contractor alerted SeaWorld, who in turn registered concern with the City about an identified "contaminated plume" migrating toward its then east leasehold line.

As there has been no remediating of either the toxic waste dump, or the landfill in the interim, there are valid concerns for public safety and health. Indeed, more rusting of barrels submerged below the salt water table may well have exacerbated the situation since 1959.

It is critical to know the extent of a large toxic repository inside a public park. Public safety and the precautionary public health principal demand that the toxic deposits in a public park, visited by 15,000,000 annually, as well as the near-by beach shore, which are visited by 14,000,000 people annually, be located and remediated.

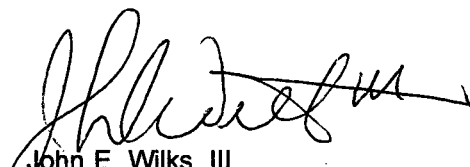
CONCLUSIONS & RECOMMENDATIONS

The California Earth Corps is concerned with City's denial of the potential safety risks and its long term pattern of conduct which is characterized by not addressing the contamination. Site monitoring is ever less frequent, encompasses fewer testing sites, is conducted at shallower depths, and directed toward far less problematic substances. Nevertheless, we note wildlife dieoffs and deformities. We note also that tests after the EPA site re-scoring reveal groundwater migration of toxics toward five major water bodies from the unlined toxic facility.

We are concerned with the adequacy and partiality of the City functioning as landlord, leasing agent, and beneficiary of any tax revenue generated from the new construction underway. It appears to us that the City may be conflicted in this time of revenue shortfalls and may not be able to objectively assess health and safety risks posed by the hydrogen sulfide. The City also seems oblivious to the deterioration of metal barrels of hazardous material in the subsurface.

For these reasons, among others, we urge your Agency to revisit its decade-old finding that the site is not worthy of Superfund Listing. If you consider all the new relative facts and developments, linked with a lack of remediation of the site in the interim, we believe you will reaffirm your original finding that the site is highly toxic and dangerous. The California Earth Corps urges you to consider this known highly contaminated site, that you previously verified contained 86 pollutants (of which 68 were EPA priority pollutants) as a candidate for inclusion on the National Priority Listing (NPL) for remediation. If, in the alternative, due to funding constraints or other higher priorities, you find that the site is not eligible for immediate cleanup, then we recommend that you make an administrative finding that the site is too contaminated for use as a State Park or commercial theme Park, and therefore must be abandoned until it is rehabilitated.

Sincerely,


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Scott Andrews
Member,
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Enclosures

- 1-Study, TI Corp, 01/02
- 2-Letter, DTSC, SD. 5/14/03
- 3-Recapitulation, Substances 11/83
- 4-Area Maps (5each)
 - a. Mission Bay Park
 - b. Mission Bay State Park
 - c. Selected Ground Water Results (ERCE)
 - d. Topo. Landfill (Fig. 4.11-1)
 - e. Aerial. Mission Bay Landfill 2/99

CC

Air Pollution Control District, SD

See Post Script on Following Page

Post Script (May 19, 2003)

After preparing this letter, additional, pertinent documents came to light. We note that on February 3, 2003, the California Regional Water Quality Control Board (San Diego Region) revised the title of its Order 97-11, pertaining to the site, as follows: General Waste Discharge Requirements for Port-Closure Maintenance of inactive Landfills Containing Hazardous and Nonhazardous Wastes within the San Diego Region" (Emphasis Added). We have no explanation for this revision, but we understand that it clarifies the state of the facility and more accurately describes its contents.

Secondly, and significantly more importantly, we have just gained access to the "Assessment Report—SeaWorld Lease Expansion", dated June 9, 1997, by Fluor Daniel GTI. ON page 6 of the Report, section 5.1 Drilling, in applicable part, it states: " On December 20 and 23, 1996, wells LE-1, LE-2, and LE-3 were drilled and installed in the lease expansion area (Figure 2). During the drilling of LE-4, on December 23, hydrogen sulfide gas was detected at concentration as high as 9 PPM and methane was detected at a maximum of 1,000 PPM. Drilling was immediately halted and boring LE-4 was back filled." (Emphasis added).

We believe the trilogy is now complete. The historical record shows that: (1) In 1988, while excavating for a boat launch ramp, seven workmen were hospitalized and one died from acute exposure to hydrogen sulfide and other gases or vapors. The City installed a sump pump and drained liquid into the sewer line for six months thereafter. (2) On December 23, 1996, Fluor Daniel workman encountered hydrogen sulfide H₂S and methane. (3) The IT Corporation in January 2002, reported methane gases at 14 of 28 filed cites, with the highest concentration (10.2%) at well J-28 at 15 ft. depth (Refer to page 4-1 of the Study) and hydrogen sulfide concentration at 1,820 PPM at well J-24d at 10 ft. depth (Refer to page 4-3 of the Study). Clearly, this is a disturbing pattern of detection.

For the reasons cited above, we again urge the Agency to reconsider its decision to twice downgrade the risk assessment of this site and to restore the 61.61 score at least until the City of the EPA can complete further investigative studies of the subsoil at the SeaWorld leasehold.

Additional Enclosures

5-Notice, CRWQCB (SD), 02/03/03

6-Report, Fluor Daniel GTI, 06/09/97


John E. Wilks, III

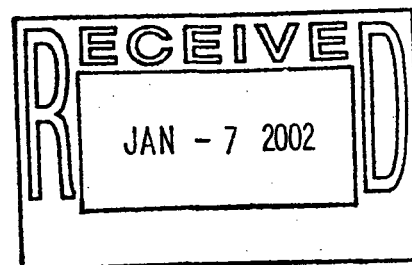
Results of Soil Vapor Assessment SeaWorld Expansion Plan, 16-Acre Tract

Prepared for

*SeaWorld San Diego
500 SeaWorld Drive
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*Prepared by
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*January 2002
IT Corporation Project 830418*



encl 1



**RESULTS OF SOIL VAPOR ASSESSMENT
SEAWORLD EXPANSION PLAN, 16-ACRE TRACT**

PREPARED FOR

**SEAWORLD SAN DIEGO
500 SEAWORLD DRIVE
SAN DIEGO, CA 92109**

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**January 2002
IT Corporation Project 830418**

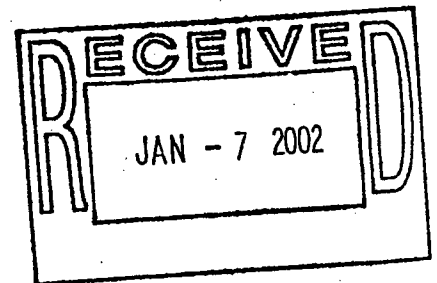


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- Appendix A Work Plan for Soil Vapor Assessment
- Appendix B Laboratory Analytical Report and Chain-of-Custody

List of Acronyms and Abbreviations

%	percent by volume
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
1,1,1-TCA	1,1,1-trichloroethane
C ₂ H ₆	ethane
CH ₄	methane
CO ₂	carbon dioxide
COC forms	chain-of-custody forms
ESD	Environmental Services Department
FADLs	Field Activity Daily Logs
FID	flame ionization detector
FID/TCA	flame ionization detector/total combustion analysis
FDGTI	Fluor Daniel GTI, Inc.
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
H ₂ S	hydrogen sulfide
IDLH	immediately dangerous to life or health
IT	IT Corporation
Landfill	Mission Bay Landfill
LEA	Local Enforcement Agency, City of San Diego Solid Waste
LFG	landfill gas
M&RP	Monitoring and Reporting Program
MEK	2-butanone
N ₂	nitrogen
O ₂	oxygen
PCBs	polychlorinated biphenyls
ppb	parts per billion
ppmv	parts per million by volume
RWQCB	Regional Water Quality Control Board
SeaWorld	SeaWorld San Diego
SVOCs	semivolatile organic compound
TCD/GC	thermal conductivity detection/gas chromatography
TGNMO	total gaseous non-methane organics
TOCs	total organic compounds
VOCs	volatile organic compounds
WDRs	Waste Discharge Requirements

1.0 Introduction and Summary of Conclusions

On behalf of SeaWorld San Diego (SeaWorld), IT Corporation (IT) prepared this report to document soil vapor data collected from the 16-acre tract of the proposed Sea World development. The proposed development is near the City of San Diego's closed Mission Bay Landfill (Landfill). While the proposed development will not encroach upon the waste-fill area of the Landfill, this work was commissioned to assess the migration of landfill gas (LFG) from the Landfill to the development area, and to determine the nature and extent of detectable soil gas parameters of concern.

This work was conducted in general accordance with the work plan approved by the City of San Diego Solid Waste Local Enforcement Agency (LEA) (Appendix A). On October 22 and 23, 2001, IT directed the installation of temporary soil vapor probes at 28 locations. On October 23 and 24, 2001, IT staff collected soil vapor samples from these probes. Using portable field meters, the soil vapor samples were analyzed for methane, carbon dioxide, oxygen and total organic compounds (TOCs). Based on these field analytical results, additional soil vapor samples were collected from five probe locations that had detectable methane, and submitted to laboratories for more detailed analyses.

Elevated methane concentrations were observed at some of the sampling locations. No field methane concentrations greater than 0.5 percent by volume (%) were found at distances greater than 400 feet from the Landfill, and all methane concentrations greater than 5 % were observed within 300 feet of the approximate edge of the Landfill. No individual volatile organic chemicals (VOCs), such as petroleum VOCs or the halogenated VOCs present in degreasers, solvents and oil aerosol propellants, were detected in any of the laboratory samples. This suggests that the source of the methane is the decomposition of buried green waste or fill soil containing a relatively high organic content, rather than typical municipal solid waste.

The methane detected in the soil vapor immediately adjacent to the Landfill is routinely found, monitored and mitigated in developments in southern California near landfills, and can be properly addressed in future development at SeaWorld using common engineering practices.

2.0 Background

The SeaWorld Master Plan (ProjectDesign Consultants, 2001) proposes to build facilities on a portion of 16 acres of land located east of the existing SeaWorld Adventure Park and north of the Mission Bay Landfill, as illustrated in Figures 1 and 2. The wastes contained in the landfill may generate LFG which is composed of methane, carbon dioxide, and toxic and/or hazardous air contaminants that may be released through a permeable soil surface. Landfill gas, if present in the vicinity of the proposed expansion, could potentially present a hazard to the constructors and to the development.

The tract proposed for development was formed by placement of fill that was dredged from Mission Bay. The fill may contain natural organic matter. The decay of organic material in the fill may generate a naturally-occurring soil gas having similarities to landfill gas.

The Mission Bay Landfill was closed in 1959, and was covered (capped) with over five feet of soil between 1959 and 1962. The landfill is currently maintained in accordance with two documents.

- *Post Closure Land Use Plan for Mission Bay South Shores Phase III* (RDI&A, et al., 1995). The post closure land use plan was prepared by the City's consultant and is functionally the City's Report of Waste Discharge and Post Closure Maintenance Plan for the landfill.
- *Order 97-11, General Waste Discharge Requirements for Post-Closure Maintenance of Inactive Nonhazardous Waste Landfills Within the San Diego Region* (RWQCB, 1997). The landfill owner, the City of San Diego, is required to comply with the Waste Discharge Requirements (WDRs) and Monitoring and Reporting Program (M&RP) presented in Order 97-11.

The City Environmental Services Department (ESD) performs groundwater and surface water detection monitoring at the frequency required by Order 97-11. The City has two groundwater monitoring wells on the perimeter of the landfill in the vicinity of the proposed SeaWorld expansion. The data collected by the City has not indicated a landfill release to groundwater in the vicinity of the proposed expansion area (EMCON/OWT, 2001).

In 1997, SeaWorld contracted Fluor Daniel GTI, Inc. (FDGTI) to perform a Phase II Environmental Assessment of the land east of the existing adventure park and north of the landfill (FDGTI, 1997). FDGTI drilled and constructed six groundwater monitoring wells, and

sampled and analyzed groundwater from the wells. The results indicated low concentrations of acetone and 2-butanone (MEK) were present in soil, and trace concentrations of 1,1,1-trichloroethane (1,1,1-TCA) were present in groundwater. Acetone had a maximum soil concentration of 220 micrograms per kilogram ($\mu\text{g/kg}$) (220 parts per billion by weight [ppb]). MEK was detected once in soil at a concentration of 36 ppb. 1,1,1-TCA had a maximum concentration of 7.2 micrograms per liter ($\mu\text{g/L}$) (7.2 ppb) in groundwater. FDGTI also detected hydrogen sulfide gas (9 parts per million by volume [ppmv]) and methane (1,000 ppmv) in one soil boring at a depth of 35 feet.

The Regional Water Quality Control Board (RWQCB) requested in 2001 that the City ESD and SeaWorld jointly gauge and sample their respective wells to provide an up-to-date "snapshot" of groundwater elevations and groundwater concentrations. The joint monitoring event occurred in the week of July 9, 2001 (EMCON/OWT, 2001).

Wells within the proposed expansion area (LE-1, LE-4, LE-6, MBW-2, and MBW-3) were analyzed for VOCs, semivolatile organic compound (SVOCs), pesticides, herbicides, and polychlorinated biphenyls (PCBs), one VOC was detected. Diethyl ether was present in wells MBW-2 and MBW-3 at trace concentrations of 1.7 and 3.6 ppb ($\mu\text{g/L}$). One SVOC compound, bis(2-ethylhexyl)phthalate, was detected in Wells LE-1 and MBW-2 at concentrations of 11.2 and 3.6 ppb (EMCON/OWT, 2001).

The following table summarizes the groundwater and soil results reported by FDGTI (1997) and EMCON/OWT (2001).

Summary of Previously Collected Soil and Groundwater Data

Chemical Name (CAS Number)	Media Detected (Date)	Maximum Detected Concentration	Regulatory Limits	Notes
Acetone (67-64-1)	Soil (1997)	220 µg/kg	PRG 6,200 mg/kg	Chemical is a common laboratory contaminant, and the detection may be a false positive.
2-butanone (78-93-3)	Soil (1997)	36 µg/kg	PRG 28,000 mg/kg	Chemical is a common laboratory contaminant, and the detection may be a false positive.
1,1,1-trichloroethane (71-55-6)	Groundwater (1997) [not detected in 2001]	7.2 µg/L	MCL 200 µg/L PRG 540 µg/L	
Diethyl ether (60-29-7)	Groundwater (2001)	3.6 µg/L	PRG 1,200 µg/L	Chemical is a common laboratory contaminant, and the detection may be a false positive.
Bis(2-ethylhexyl)phthalate (117-81-7)	Groundwater (2001)	11.2 µg/L	MCL 4 µg/L PRG 4.8 µg/L	Chemical is a common laboratory contaminant, and the detection may be a false positive.

Explanation:

CAS = Chemical Abstracts Service registry number.

MCL = primary Maximum Contaminant Level for drinking water (California Dept. of Health Services).

PRG = Preliminary Remediation Goal (for industrial soil or tap water) published in the lookup table of screening values published in the U.S. EPA Region IX "PRG2000 Table."

µg/kg = micrograms per kilogram (parts per billion [ppb]).

µg/L = micrograms per liter (parts per billion [ppb]).

mg/kg = milligrams per kilogram (parts per million [ppm]).

General note about regulatory limits:

The MCLs and PRGs are provided here for comparison purposes only. The MCLs and PRGs for groundwater are only applicable to drinking water, and are not applicable at the subject site because the local groundwater is not used for drinking water purposes and the aquifer is not designated for beneficial use by the RWQCB.

3.0 Collection and Analysis of Soil Vapor Samples

This section addresses probe construction methods and details, sample collection methods, and analytical techniques used for soil vapor samples.

3.1 Soil Vapor Probe Construction

Soil vapor probes were constructed at the 28 locations illustrated in Figure 2. The locations were spaced at approximately 100-foot intervals. The temporary soil vapor probes were installed by HP Labs using a truck-mounted direct push/hammer Strataprobe drilling rig. The direct push drilling method advances a 2-inch-diameter drive point and produces no soil cuttings. The soil displaced by drilling is pushed laterally away from the boring.

The work plan proposed that soil vapor probes be installed at depths of 5- and 15-feet, at each location. Because of the shallow groundwater encountered at some locations, the proposed 15-foot probe was not completed at those locations. Instead, the deep probe was installed at 10 or 12 feet below ground surface or no deep probe was installed. No borings were advanced beyond the water table, which is between 10- and 20-feet below grade (EMCON/OWT, 2001). Table 1 lists the construction details for each soil vapor probe.

A typical deep probe included a steel penetration cone with gas inlet perforations. The cone attached to 1/8-inch diameter nylon tube that connected the penetration cone to the sampling port located above the ground surface. Silica sand was added to the annular space surrounding the gas inlet perforation to create a sand pack around the probe.

After completing the deep probe sand pack, bentonite was added to the annular space of the boring, and hydrated in two-foot lifts. When the annular space had been filled up to five feet below grade, a 1-inch long screen (connected to nylon tubing) was lowered down the boring into the annular space to act as the shallow vapor probe. This screen was then surrounded by sand. The remainder of the annular space was filled with bentonite, hydrated in two-foot lifts.

The surface expression of a typical vapor probe installation consisted of two 1/8-inch-diameter nylon tubes exiting the ground surface, and sealed with a Tygon ball valve. The ball valves allowed the tube to be sealed from atmospheric influence when the vapor probes were not in use, and allowed subsequent sampling at convenient times.

4.0 Analytical Results

This section describes the analytical results and provides an interpretation of the data.

4.1 Field Analytical Results

Table 2 provides tabulated results for the field analyses. The field methane measurements are illustrated in Figure 3.

Methane gas was not detected at 14 of the 28 probe locations; that is, the concentration of methane was below the detection limit of approximately 0.1 %. Six of the probe locations had methane concentrations greater than 1 %, and four probe locations had methane concentrations greater than 5 %. The highest methane concentration, 10.2 %, was detected at soil vapor probe J-28s. Total organic compound concentrations ranged from undetectable (<0.1 ppmv) to greater than 50,000 ppmv (the FID had a maximum detectable concentration of 50,000 ppmv). The highest TOC concentrations were detected at probes J-21s, J-24d, and J-28s. A qualitative comparison of the TOC and methane results indicates that the TOC and methane concentrations are approximately directly proportional.

Carbon dioxide concentrations ranged from non-detect (<0.1 %) to 19.5 %, and oxygen concentrations ranged from 7.2 % to 20.5 %. A qualitative comparison of the concentrations of methane, oxygen and carbon dioxide concentrations collected from the 28 probe locations indicates that, in general:

- Increasing methane concentrations corresponded to decreasing oxygen concentrations
- Increasing methane concentrations corresponded with increasing carbon dioxide concentrations.

4.2 Laboratory Analytical Results

Table 3 provides tabulated results for the five soil vapor samples analyzed at fixed base laboratories. The laboratory results are also depicted on the site plan in Figure 4. The laboratory analytical reports are provided in Appendix B.

Several observations are noted in the laboratory data.

- The laboratory methane results ranged from 0.43 % to 21.6 %, and were consistent with the field analytical results
- Ethane concentrations ranged from non-detect (<0.1 ppmv) to 14.4 ppmv
- The concentration of TGNMO ranged from 4.02 to 78.0 ppmv
- The concentration of hydrogen sulfide ranged from nondetect (<0.3 ppmv) to 1,820 ppmv
- No individual VOCs (e.g., halogenated VOCs and petroleum VOCs) were detected in the VOC individual analysis

4.3 Discussion of Analytical Results

Methane in shallow soil typically results from anaerobic decomposition of buried organic matter. The methane vapor that is generated by organic decay typically migrates away from the source toward areas of lower concentration via advection and diffusion. The distribution of methane field analytical results in Figure 3 illustrates that the highest methane concentrations (up to a maximum of 10.2 %), and all methane concentrations greater than 5 %, were observed within 300 feet of the approximate edge of the Mission Bay Landfill. At distances of greater than 400 feet from the landfill, the field methane concentrations were all below 0.5 %. The geographic distribution of methane data indicates that the source of methane is in the vicinity of the Mission Bay Landfill.

The field analytical results for a number of soil vapor probes (Figure 5) illustrate that elevated methane concentrations are coincident with decreased oxygen concentrations and increased carbon dioxide concentrations (e.g., probe J-28s, Table 2). These data relationships are consistent with anaerobic degradation being the source of methane.

Several probes have field analytical data that indicate aerobic degradation of organic matter. For instance, the presence of elevated TOC concentrations accompanied by near atmospheric concentrations of oxygen indicates that aerobic decomposition of organic material is occurring. Another indicator of aerobic decomposition is the presence of carbon dioxide with an absence of methane. This occurs because carbon dioxide is the respiratory by-product of aerobic microbial activity. Both of these indicators suggest that the fill contains a relatively high organic content that, in places, is degrading aerobically.

The low ethane concentrations (relative to methane) indicate that the methane source is decay of organic matter, and not petroleum natural gas.

Municipal solid waste landfill gas often contains trace concentrations of volatile organic compounds such as halogenated VOCs (e.g., the halogenated VOCs present in degreasers, solvents and old aerosol propellants) and petroleum VOCs (e.g., benzene, toluene, xylenes, ethylbenzene). No individual VOCs were detected in the soil vapor samples analyzed by GC/MS method. This suggests that the source of methane may not be typical landfill gas, such as municipal solid waste. Rather, the source of methane may be buried green waste or fill soil containing a relatively high organic content.

Volatile organic compounds were essentially not detectable in both groundwater and soil gas (the VOC detections in groundwater were only traces, or were possibly laboratory cross contamination). At other landfills, investigators have observed that the detection of VOCs in soil vapor is associated with corresponding detections of VOCs in groundwater, generally due to diffusion transport of VOCs from vapor into groundwater. In this investigation of Mission Bay Landfill, the VOC soil gas and groundwater results were both nondetect, which is consistent.

A portion of the organic matter may be in the form of sulfur compounds, which under anaerobic and sometimes under certain aerobic conditions, are converted to hydrogen sulfide. Typically, in most landfills, the hydrogen sulfide concentration is between 5 and 200 ppmv. The difference in the range is usually attributed to how much sludge the landfill received from sewage treatment plants or in a few cases the amount of construction material (drywall) accepted to the landfill. Sulfur reducing bacteria are present everywhere and these types of substrate lead to hydrogen sulfide production.

The unusually high concentration of hydrogen sulfide at one probe (1,820 ppmv in probe J-24d) is likely either an anomaly or the result of a deposit of sulfur materials in close proximity to the probe. Hydrogen sulfide is dangerous at a concentration of 10 ppmv and has an IDLH (Immediately Dangerous to Life or Health) concentration of 100 ppmv. While the concentration of the hydrogen sulfide in probe J-24d was above health safety limits, the concentration in the air above a landfill site is typically 2 to 3 orders of magnitude less, as the soil vapor dissipates into the atmosphere. However, caution and monitoring should still be applied at this location.

4.4 Discussion of Regulatory and Safety Issues

Our interpretation of the analytical data leads us to conclude that the Mission Bay Landfill is the source of relatively elevated concentrations of methane detected in soil vapor adjacent to the Mission Bay Landfill. This methane can be monitored and mitigated in future site development. In fact, methane is routinely monitored and mitigated at developments in southern California,

particularly in the Los Angeles Basin and Newport Beach areas where methane is encountered more frequently and methane mitigation measures are addressed in local building codes (methane in these areas is typically due to naturally occurring petroleum).

Landfill gas in this San Diego location is subject to the regulations in Title 27 -- the combined regulations relevant to landfills, enforced by the California Integrated Waste Management Board and the State Water Resources Control Board -- and may be subject to additional regulations, including local building codes. IT believes that several safety practices and requirements of Title 27 apply to this site, based on the data collected in this study.

- The landfill owner should implement a landfill gas investigation, and possibly a gas monitoring program, that is in accordance with Title 27.
- The landfill owner must ensure "that the concentration of methane does not exceed the lower explosive limit for methane at the facility property boundary" (Title 27). The LEL for methane is 5 %.
- Enclosed structures such as enclosed buildings, basements, vaults and sumps, that are constructed within 1,000 feet of a landfill boundary may require periodic methane monitoring or continuous methane monitoring (e.g., a methane detector and alarm).
- If structures are built near the landfill, in the future, then the design may need to incorporate gas mitigation measures, such as active gas control measures (e.g., gas extraction wells) or passive gas control measures (e.g., cutoff trenches, slurry walls and vent trenches).
- If structures have the potential to accumulate methane gas in enclosed spaces, then gas control measures may need to be incorporated into the structure (e.g., flexible membrane liners beneath foundations and floors, passive or active vent systems, gas detectors with alarms, and ignition source control).
- If the landfill and surrounding land is paved with materials that are impermeable to landfill gas, then there is potential to increase the effective seal of the ground surface. This could result in increased concentrations of landfill gas accumulating within soil vapor.

The landfill gas documented in this investigation can be mitigated in future development using common engineering practices.

5.0 References

- Department of Environmental Health, Site Assessment and Mitigation Division (County of San Diego), 2001. *Draft Guidelines for Laboratory Analysis of Soil Gas Samples*. May 1.
- EMCON/OWT, 2001. *Groundwater Conditions in the Vicinity of Mission Bay Landfill*. September 27. Prepared for the City of San Diego Environmental Services Department.
- Fluor Daniel GTI, Inc. (FDGTI), 1997. *Assessment Report, Sea World Lease Expansion*. June 9. Prepared for SeaWorld.
- ProjectDesign Consultants, 2001. *Master Plan Update. Final Draft*. March 23.
- RDI&A, RBF/Sholders and Sanford, Woodward-Clyde Consultants, Randall Lamb Associates, 1995. *Postclosure Land Use Plan for Mission Bay South Shores Phase III*. September, revised October. Prepared for the City of San Diego Park Development and Open Space Division.
- Regional Water Quality Control Board (RWQCB), 1997. *Order 97-11, General Waste Discharge Requirements for Post-Closure Maintenance of Inactive Landfills within the San Diego Region*.

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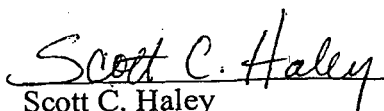
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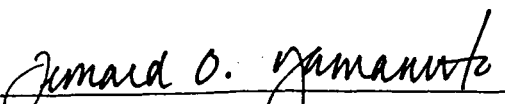
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This report was prepared in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.



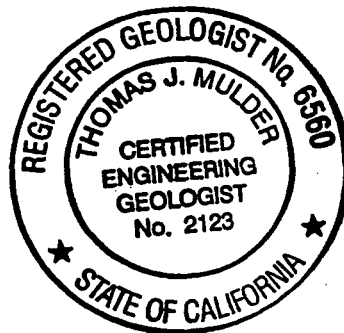
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TABLES

TABLE 1
Details of Temporary Soil Vapor Probes
SeaWorld San Diego

Probe ID	Approximate Elevation of Ground Surface (feet)	Depth of "Shallow" Probe (feet)	Depth of "Deep" Probe (feet)
J-1	21	5	10
J-2	10	5	NC
J-3	18	5	10
J-4	18	5	10
J-5	17	5	10
J-6	13	5	NC
J-7	11	5	NC
J-8	18	5	10
J-9	13	5	NC
J-10	15	5	10
J-11	20	5	10
J-12	16	5	10
J-13	16	5	10
J-14	21	5	15
J-15	18	5	10
J-16	18	5	10
J-17	19	5	12
J-18	19	5	15
J-19	20	5	15
J-20	18	5	15
J-21	19	5	15
J-22	19	5	15
J-23	19	5	15
J-24	19	5	15
J-25	20	5	15
J-26	19	5	15
J-27	20	5	15
J-28	20	5	15

Notes:

- 1) Soil vapor probes were installed on October 22 and 23, 2001.
- 2) The annulus between the deep and shallow probes was filled with bentonite.
- 3) The annulus surrounding the soil gas screens was filled with silica sand.
- 4) NC = not constructed

TABLE 2
Field Analytical Results
SeaWorld San Diego

Probe ID	Depth	Date	Time	Methane (CH ₄) %	Carbon Dioxide (CO ₂) %	Oxygen (O ₂) %	Balance Gas %	Total Organic Compounds (TOC) ppmv	Notes
J-1	Shallow	10/24/2001	1230	0.0	0.0	20.4	79.6	36	
J-1	Deep	10/24/2001	1235	0.0	1.3	18.8	79.9	59	Slight sulfur odor
J-2	Shallow	10/24/2001	1240	0.1	3.5	18.0	78.4	2,564	Sulfur odor
J-2	Shallow	10/25/2001	645	0.0	2.8	18.8	78.4	2,600	
J-3	Shallow	10/24/2001	1355	0.0	1.0	18.4	80.6	41	
J-3	Deep	10/24/2001	1400	0.0	0.9	18.9	80.2	68	
J-4	Shallow	10/24/2001	1220	0.0	0.9	19.0	80.1	30	
J-4	Deep	10/24/2001	1225	0.0	0.8	19.2	80.0	29	
J-5	Shallow	10/24/2001	1210	0.0	0.6	19.7	79.7	32	
J-5	Deep	10/24/2001	1215	0.0	0.4	19.7	79.9	34	
J-6	Shallow	10/24/2001	1200	0.0	0.0	20.4	79.6	34	
J-7	Shallow	10/24/2001	1150	0.0	0.9	19.0	80.1	41	
J-8	Shallow	10/24/2001	1245	0.0	0.3	19.7	80.0	413	
J-8	Deep	10/24/2001	1250	0.0	1.0	18.7	80.3	1,110	
J-9	Shallow	10/24/2001	1130	0.0	3.5	16.5	80.0	46	
J-10	Shallow	10/24/2001	1135	0.0	0.4	19.8	79.8	43	
J-10	Deep	10/24/2001	1140	0.0	0.3	19.9	79.8	41	
J-11	Shallow	10/23/2001	1720	0.1	1.9	17.1	80.9	NA	
J-11	Shallow	10/24/2001	1255	0.0	1.4	19.0	79.6	41	
J-11	Deep	10/23/2001	1730	0.2	2.9	15.8	81.1	NA	
J-11	Deep	10/24/2001	1300	0.1	1.1	18.8	80.0	2,859	
J-12	Shallow	10/24/2001	1115	0.0	0.0	20.2	79.8	49	
J-12	Deep	10/24/2001	1120	0.0	0.9	18.9	80.2	55	
J-13	Shallow	10/24/2001	1105	0.0	0.8	19.2	80.0	275	
J-13	Deep	10/24/2001	1110	0.0	3.7	15.3	81.0	1,000	
J-14	Shallow	10/23/2001	1700	0.0	NA	NA	NA	NA	
J-14	Shallow	10/24/2001	1305	0.0	1.9	19.0	79.1	900	
J-14	Shallow	10/25/2001	730	0.0	3.8	18.1	78.1	1,600	Sulfur odor
J-14	Deep	10/23/2001	1710	6.1	5.7	12.6	75.6	NA	
J-14	Deep	10/24/2001	1310	0.7	0.8	19.3	79.2	13,900	
J-14	Deep	10/25/2001	730	1.6	1.9	18.3	78.2	35,000	Sulfur odor
J-15	Shallow	10/24/2001	1040	0.0	0.2	19.8	80.0	71	
J-15	Deep	10/24/2001	NA	0.3	1.1	18.9	79.7	4,380	

TABLE 2
Field Analytical Results
SeaWorld San Diego

Probe ID	Depth	Date	Time	Methane (CH ₄) %	Carbon Dioxide (CO ₂) %	Oxygen (O ₂) %	Balance Gas %	Total Organic Compounds (TOC) ppmv	Notes
J-16	Shallow	10/24/2001	1055	0.1	0.2	20.0	79.7	2,420	
J-16	Deep	10/24/2001	1100	0.5	0.7	19.3	79.5	7,050	
J-17	Shallow	10/23/2001	1640	0.0	2.9	17.8	79.3	NA	
J-17	Shallow	10/24/2001	1345	0.0	0.6	19.8	79.6	37	
J-17	Deep	10/23/2001	1650	0.5	0.2	20.1	79.2	NA	
J-17	Deep	10/24/2001	1350	0.1	0.0	20.4	79.5	1,844	Strong sulfur odor
J-18	Shallow	10/23/2001	1600	0.1	8.9	15.8	75.2	NA	
J-18	Shallow	10/24/2001	1335	0.0	3.4	18.6	78.0	890	
J-18	Deep	10/23/2001	1620	0.0	0.0	20.3	79.7	NA	
J-18	Deep	10/24/2001	1340	0.0	0.0	20.4	79.6	34	
J-19	Shallow	10/23/2001	1530	0.0	0.0	20.4	79.6	NA	
J-19	Shallow	10/24/2001	1315	0.2	2.4	18.6	78.8	4,200	
J-19	Deep	10/23/2001	1545	NA	NA	NA	NA	NA	No vapor flow
J-19	Deep	10/24/2001	1320	0.0	0.0	20.5	79.5	38	
J-20	Shallow	10/24/2001	1000	0.2	0.2	20.2	79.4	2,778	
J-20	Deep	10/24/2001	1005	0.0	0.0	20.4	79.6	32	Very low vapor flow rate
J-21	Shallow	10/24/2001	945	6.2	5.5	16.2	72.1	>50,000	FID flame out
J-21	Shallow	10/25/2001	655	6.1	4.7	17.4	71.8	47,000	FID flame out
J-21	Deep	10/24/2001	950	0.0	0.0	20.5	79.5	32	
J-22	Shallow	10/23/2001	1345	0.0	5.1	17.2	77.7	NA	
J-22	Shallow	10/24/2001	1405	0.0	1.6	19.2	79.2	86	
J-22	Deep	10/23/2001	1345	NA	NA	NA	NA	NA	Water in probe line
J-22	Deep	10/24/2001	1410	NA	NA	NA	NA	NA	No vapor flow, water in vapor line
J-23	Shallow	10/23/2001	1400	1.6	8.9	15.3	74.2	NA	
J-23	Shallow	10/24/2001	1415	0.5	1.4	19.3	78.8	6,600	
J-23	Deep	10/23/2001	1400	NA	NA	NA	NA	NA	Water in probe line
J-23	Deep	10/24/2001	1420	0.0	0.0	20.4	79.6	30	
J-24	Shallow	10/23/2001	1420	0.0	5.5	16.0	78.5	NA	
J-24	Shallow	10/24/2001	1425	0.6	2.2	18.7	78.5	10,700	Sulfur odor
J-24	Shallow	10/25/2001	720	8.4	8.8	16.2	66.6	>50,000	Sulfur odor
J-24	Deep	10/23/2001	1440	1.8	1.2	18.9	78.1	NA	Strong sulfur odor
J-24	Deep	10/24/2001	1430	3.6	2.7	19.0	74.7	>50,000	Strong sulfur odor
J-24	Deep	10/25/2001	725	9.4	7.5	17.4	65.7	>50,000	FID Flame out; Strong sulfur odor

TABLE 2
Field Analytical Results
SeaWorld San Diego

Probe ID	Depth	Date	Time	Methane (CH ₄) %	Carbon Dioxide (CO ₂) %	Oxygen (O ₂) %	Balance Gas %	Total Organic Compounds (TOC) ppmv	Notes
J-25	Shallow	10/23/2001	1500	0.0	2.5	17.9	79.6	NA	
J-25	Shallow	10/24/2001	1435	0.0	1.3	19.0	79.7	25	
J-25	Deep	10/23/2001	1515	0.0	0.0	20.4	79.6	NA	
J-25	Deep	10/24/2001	1440	0.0	0.0	20.4	79.6	23	
J-26	Shallow	10/24/2001	900	2.1	2.3	19.4	76.2	34,000	
J-26	Deep	10/24/2001	915	0.0	0.0	20.4	79.6	2	
J-27	Shallow	10/24/2001	920	0.0	0.3	20.1	79.6	716	
J-27	Deep	10/24/2001	925	0.0	0.0	20.5	79.5	13	Water in probe line, strong sulfur odor
J-28	Shallow	10/23/2001	1335	10.2	19.5	7.2	63.1	1,775	
J-28	Shallow	10/24/2001	1445	6.0	7.6	15.5	70.9	>50,000	FID flame out
J-28	Shallow	10/25/2001	710	4.0	6.4	16.6	73.0	>50,000	FID flame out
J-28	Deep	10/23/2001	1340	0.0	0.0	20.5	79.5	2	
J-28	Deep	10/24/2001	1450	NA	NA	NA	NA	NA	Water in vapor line

NOTES

- 1) % = percent by volume
- 2) ppmv = parts per million by volume
- 3) Measurements were conducted after purging three liters from each vapor probe.
- 4) Methane, carbon dioxide, and oxygen levels were measured using a CES Landtec GEM 500. Methane levels were detected by infrared absorption while carbon dioxide and oxygen were detected by galvanic cell.
- 5) Total organic compound (TOC) values were measured using a flame ionization detector (FID) calibrated to methane.
- 6) NA = not analyzed.

TABLE 3
Fixed Laboratory Analytical Results
SeaWorld San Diego

Probe ID	Depth of Probe	Methane (CH ₄) (%)	Carbon Dioxide (CO ₂) (%)	Oxygen (O ₂) (%)	Nitrogen (N ₂) (ppmv)	Hydrogen Sulfide (H ₂ S) (ppmv)	Ethane (C ₂ H ₆) (ppmv)	Total Gaseous Non-methane Organics (ppmv)	Individual Volatile Organic Compounds (ppmv)
J-2	Shallow	0.43	7.51	16.2	75.5	ND (<0.3)	ND (<1.0)	4.02	ND (<1.0)
J-14	Deep	3.17	2.95	17.8	76.4	0.47	4.97	27.3	ND (<1.0)
J-21	Shallow	21.6	15.6	9.6	53.5	9.41	14.4	60.7	ND (<1.0)
J-24	Deep	13.1	10.9	16.0	60.2	1,820	7.55	78.0	ND (<1.0)
J-28	Shallow	8.97	14.9	11.3	65.2	ND (<0.3)	3.46	132	ND (<1.0)

Notes:

- 1) % = percent by volume
- 2) ppmv = parts per million by volume
- 3) Vapor samples were collected after purging three liters from each vapor probe.
- 4) The samples were collected on October 25, 2001.
- 5) Methane, carbon dioxide, and oxygen were measured by thermal conductivity detection/gas chromatography (TCD/GC).
- 6) Hydrogen sulfide was analyzed by gas chromatography with a Hall electrolytic conductivity detector operated in an oxidative sulfur mode
- 7) "Individual Volatile Organic Compounds" comprises 24 compounds measured by EPA Method 8260B. No compounds were detected in any of the five samples.
- 8) Total Gaseous Non-methane Organics (TGNMO) was measured by flame ionization detection/total combustion analysis (FID/TCA), EPA Method 25.
- 9) ND (<0.3) = analyte at or below reported detection limit

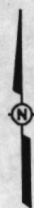
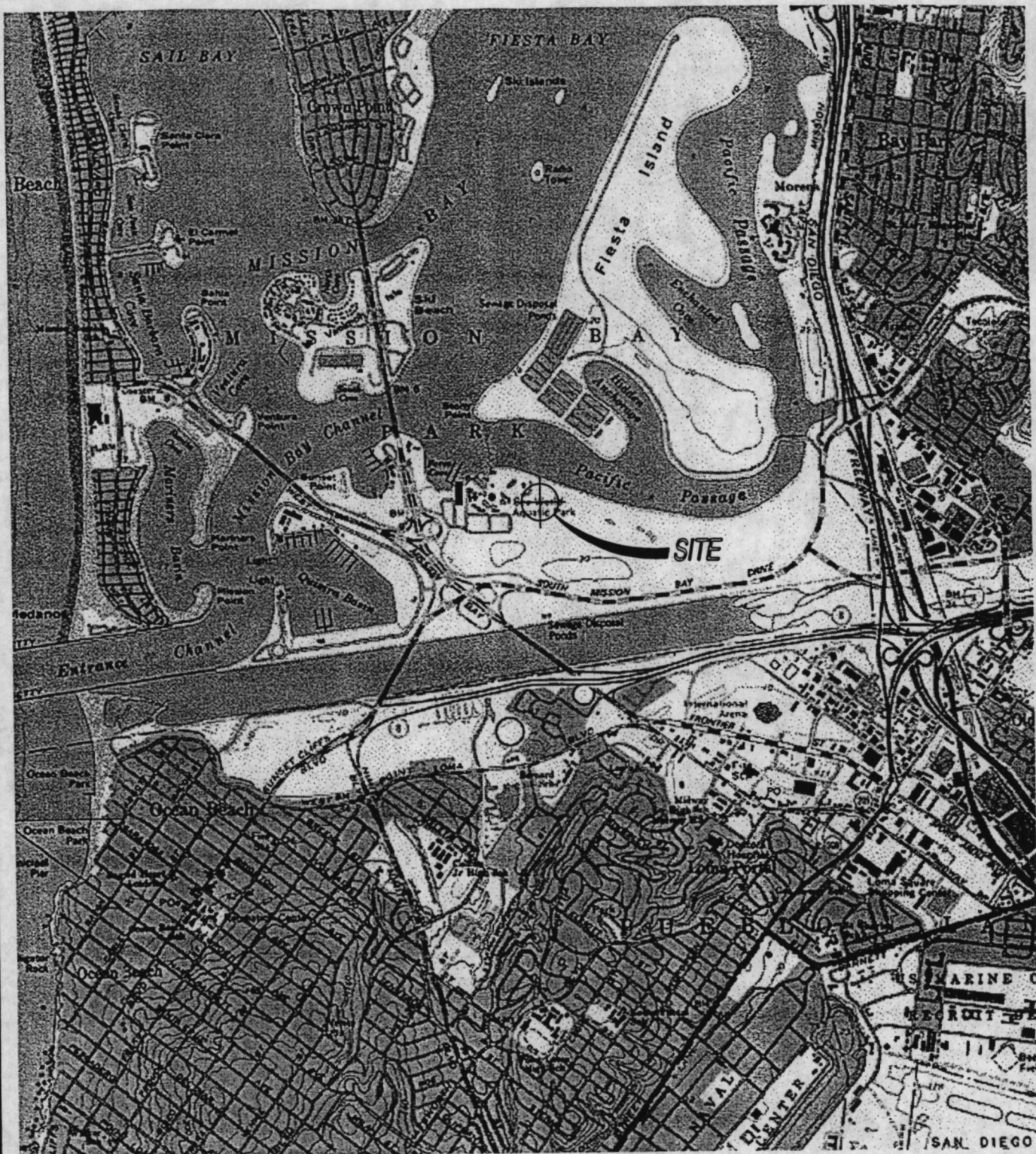
FIGURES

DRAWING NUMBER 828286-B6

APPROVED BY

CHECKED BY

DRAWN BY 10/31/01
SCH



SEAWORLD
500 SEAWORLD DRIVE
SAN DIEGO, CALIFORNIA

SOURCE
PRINTED FROM TOPO!
2001 NATIONAL GEOGRAPHIC
HOLDINGS, INC.

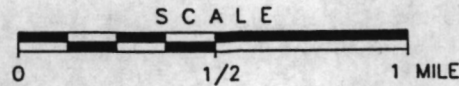
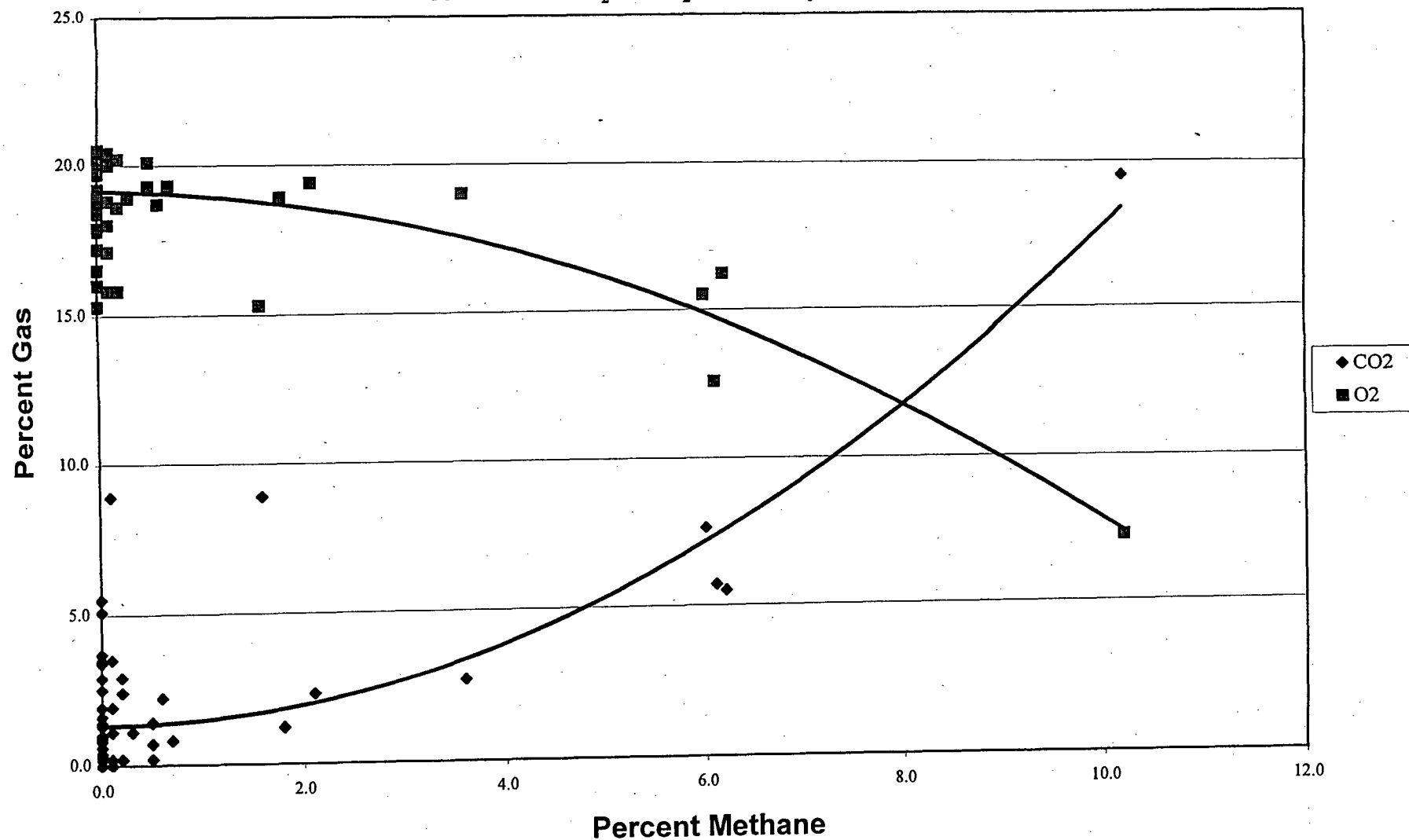


FIGURE 1
SITE MAP

FIGURE 5
Methane vs CO₂ and O₂ Field Analytical Results

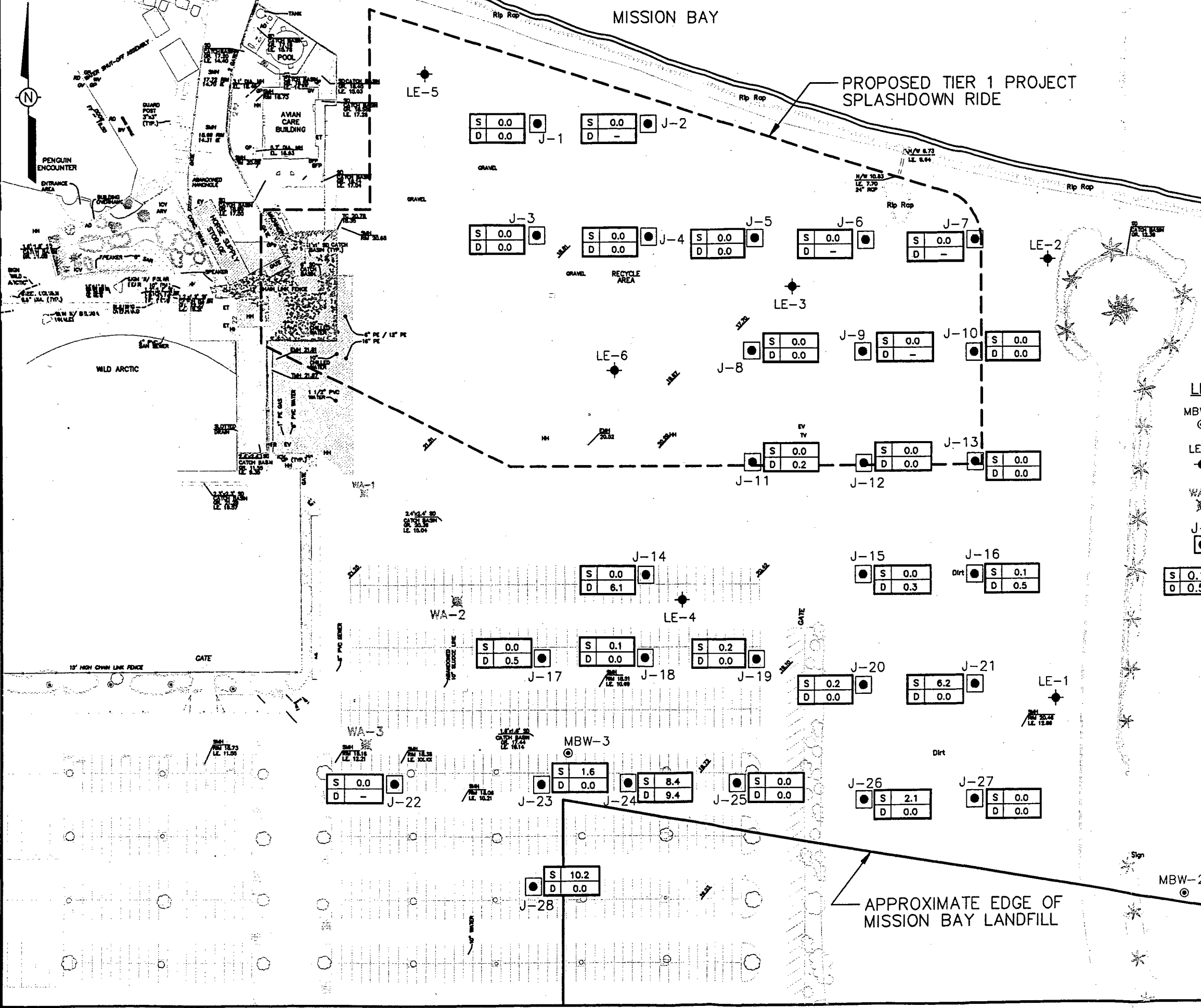


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SCH 10/31/01



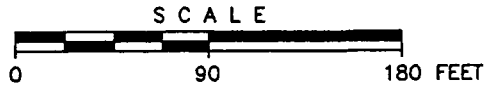
LEGEND:

- MBW-2
○ CITY ESD GROUNDWATER MONITORING WELL
- LE-2
● SEAWORLD GROUNDWATER MONITORING WELL
- WA-1
✱ ABANDONED GROUNDWATER MONITORING WELL
- J-3
● TEMPORARY SOIL VAPOR PROBE
- | | |
|---|-----|
| S | 0.1 |
| D | 0.5 |

 PERCENTAGE OF METHANE BY VOLUME AS MEASURED IN THE FIELD ON SEPTEMBER 23 & 24, 2001., USING A LANDTEC GEM 500 (ONLY THE HIGHEST PERCENTAGE ARE SHOWN)
- S = SHALLOW
- D = DEEP

NOTE:

BASE MAP PROVIDED BY PGAV, INC. LAND SURVEY DATA REPORTED TO BE FROM HALE ENGINEERING SURVEYED AUGUST, 2000



SEAWORLD
500 SEAWORLD DRIVE
SAN DIEGO, CALIFORNIA

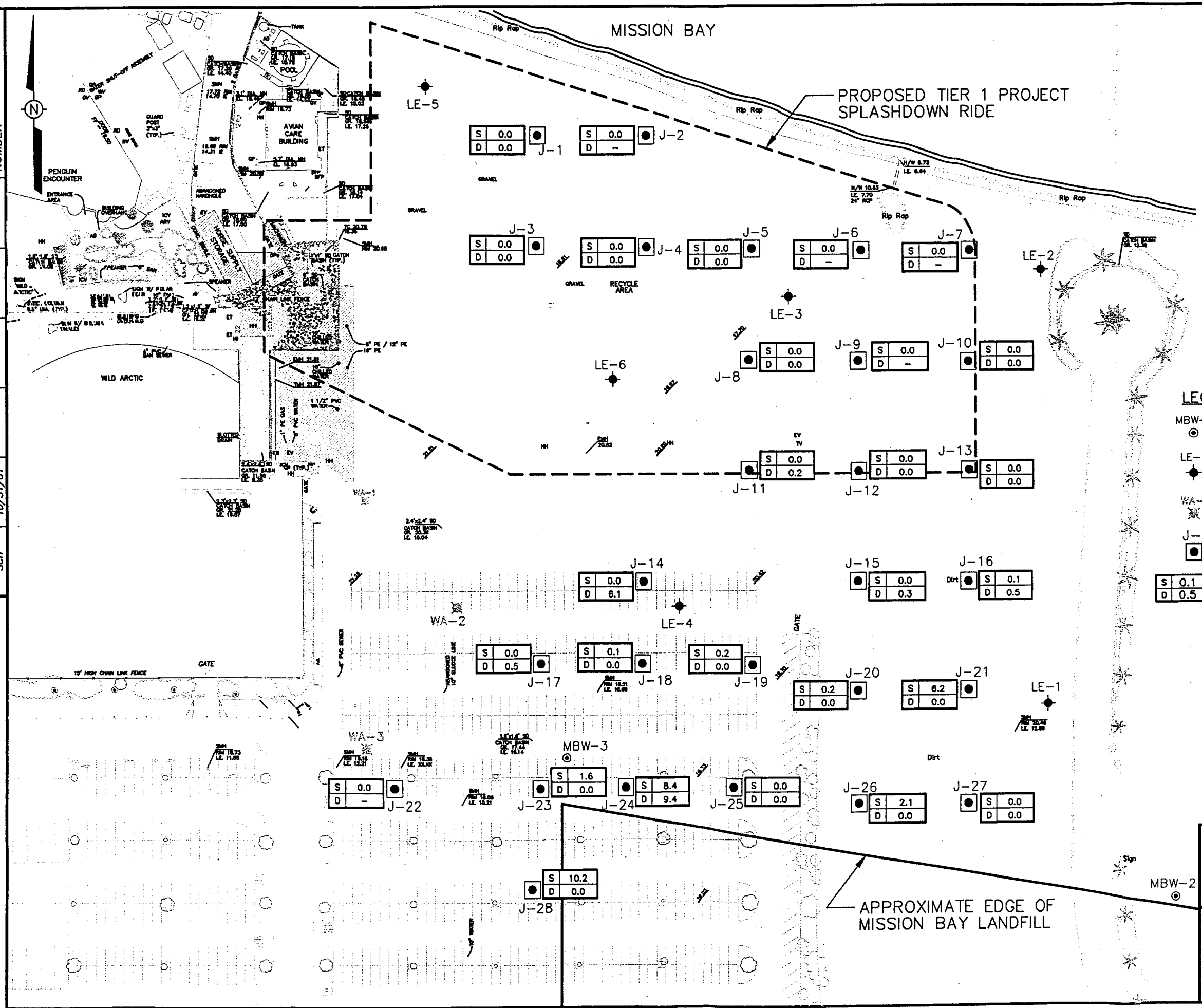
FIGURE 3
METHANE CONCENTRATIONS
MEASURED WITH FIELD METER

DRAWING 828286-B8

APPROVED BY

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SCH 10/31/01



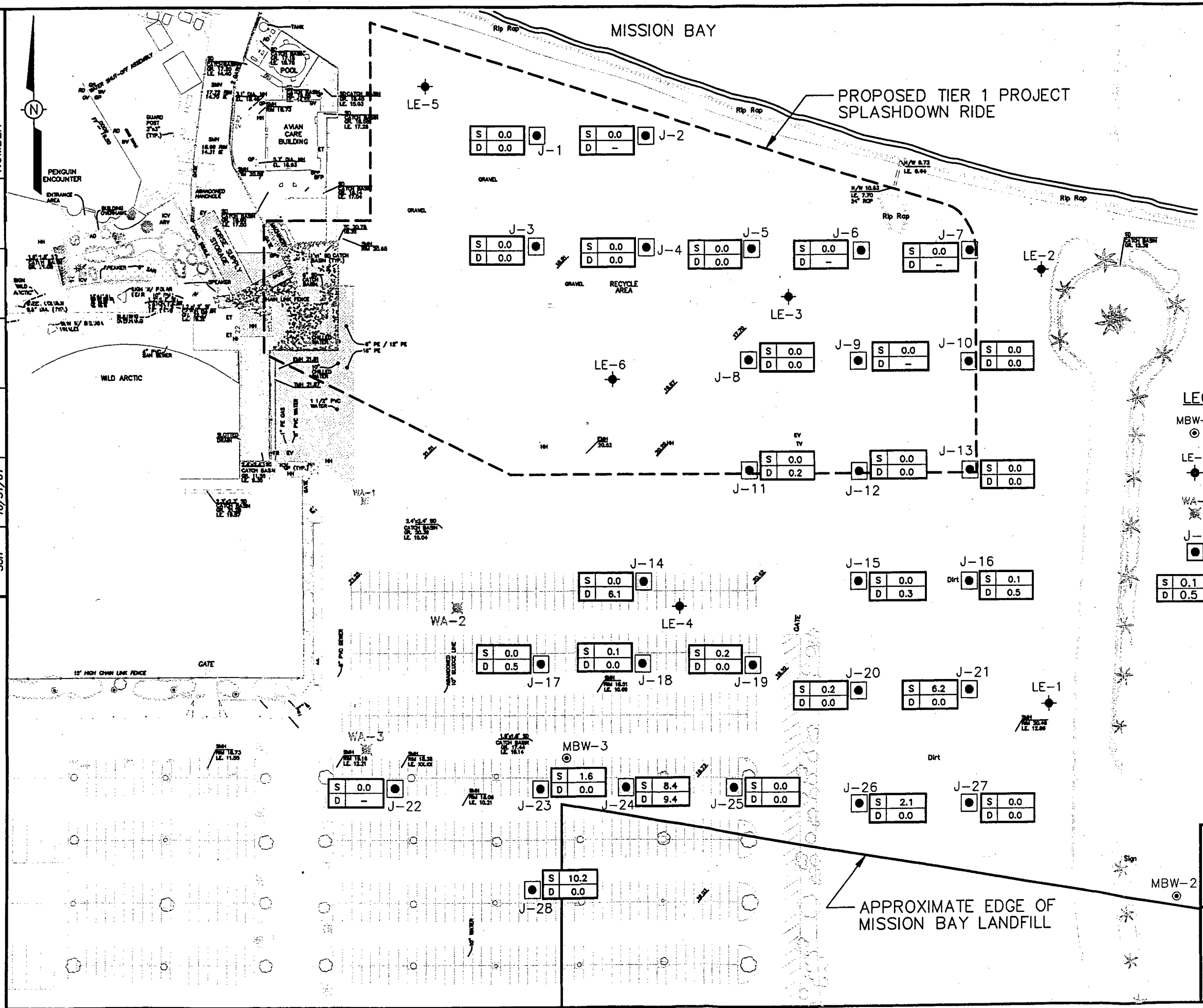
DRAWING 828286-B8

APPROVED BY

CHECKED BY

DRAWN BY

SCH 10/31/01

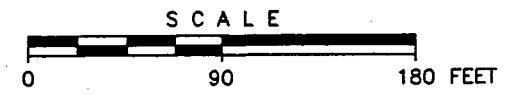


LEGEND:

- MBW-2 CITY ESD GROUNDWATER MONITORING WELL
- LE-2 SEAWORLD GROUNDWATER MONITORING WELL
- WA-1 ABANDONED GROUNDWATER MONITORING WELL
- J-3 TEMPORARY SOIL VAPOR PROBE
- PERCENTAGE OF METHANE BY VOLUME AS MEASURED IN THE FIELD ON SEPTEMBER 23 & 24, 2001., USING A LANDTEC GEM 500 (ONLY THE HIGHEST PERCENTAGE ARE SHOWN)
S = SHALLOW
D = DEEP

NOTE:

BASE MAP PROVIDED BY PGAV, INC. LAND SURVEY DATA REPORTED TO BE FROM HALE ENGINEERING SURVEYED AUGUST, 2000



SEAWORLD
500 SEAWORLD DRIVE
SAN DIEGO, CALIFORNIA

FIGURE 3
METHANE CONCENTRATIONS
MEASURED WITH FIELD METER

APPENDIX A

WORK PLAN FOR SOIL VAPOR ASSESSMENT

**IT Corporation**

1230 Columbia Street, Suite 1200
San Diego, CA 92101-8517
Tel. 619.239.1690
Fax. 619.239.1238

A Member of The IT Group

July 20, 2001

IT Corporation Project 828286

Ms. Rebecca Lafreniere, REHS
Environmental Health Specialist
Solid Waste Local Enforcement Agency
City of San Diego
1222 First Avenue, MS 501
San Diego, CA 92101-4155

Work Plan for Soil Vapor Assessment
SeaWorld Expansion Plan, 16-Acre Tract

Dear Ms. Lafreniere:

On behalf of SeaWorld, IT Corporation (IT) prepared this work plan to collect soil vapor data from the 16-acre tract of the proposed SeaWorld expansion. While the proposed expansion will not be above the Mission Bay Landfill, and the landfill is not known to generate appreciable landfill gas (LFG), a concern has been expressed that landfill gas may be present in the proposed expansion area. The objectives of this work plan are to determine if landfill gas is present in the expansion area, and to determine the nature and extent of detectable soil gas parameters of concern.

On behalf of SeaWorld, IT requests that Solid Waste Local Enforcement Agency (LEA) review and comment on this work plan by August 3, 2001, prior to the beginning of field work which is scheduled to start in August of 2001. IT has also sent copies of this work plan to the San Diego Regional Water Quality Control Board (RWQCB) and City of San Diego Environmental Services Department (City ESD) to solicit their review and comment prior to field work.

Background

The SeaWorld Master Plan (ProjectDesign Consultants, 2001) proposes to build facilities on a portion of 16 acres of land located east of the existing SeaWorld adventure park and north of the Mission Bay Landfill, as illustrated in Figure 1. The wastes contained in the landfill may generate LFG which is composed of methane, carbon dioxide, and toxic and/or hazardous air

contaminants that may be released through a permeable soil surface. Landfill gas, if present in the vicinity of the proposed expansion, could potentially present a hazard to the constructors and the development.

The tract proposed for development was formed by placement of fill that was dredged from Mission Bay. The fill may contain organic matter. The decay of organic material in the fill may generate a soil gas having similarities to landfill gas.

The Mission Bay Landfill was closed in 1959, and was covered (capped) with over five feet of soil between 1959 and 1962. The landfill is currently maintained in accordance with two documents.

- Post Closure Land Use Plan for Mission Bay South Shores Phase III (RDI&A, RBF/Sholders and Sanford, Woodward-Clyde Consultants and Randall Lamb Consultants; 1995). The post closure land use plan is functionally a Report of Waste Discharge and Post-Closure Maintenance Plan for the landfill.
- Order 97-11. General Waste Discharge Requirements for Post-Closure Maintenance of Inactive Nonhazardous Waste Landfills Within the San Diego Region (RWQCB, 1997). The landfill owner, the City ESD, is required to comply with the Waste Discharge Requirements (WDRs) and Monitoring and Reporting Program (M&RP) presented in Order 97-11.

The City ESD performs groundwater and surface water detection monitoring at the frequency required by Order 97-11. The City has two groundwater monitoring wells on the perimeter of the landfill in the vicinity of the proposed SeaWorld expansion. The data collected by the City has not indicated a landfill release to groundwater in the vicinity of the proposed expansion area. The City has also collected landfill gas data that indicate the landfill generates minor quantities of landfill gas (verbal communication between T. Mulder of IT and City ESD staff).

In 1997, SeaWorld contracted Fluor Daniel GTI (FDGTI) to perform a Phase II Environmental Assessment of the land east of the existing adventure park and north of the landfill. FDGTI drilled and constructed six groundwater monitoring wells, and sampled and analyzed groundwater from the wells. The results indicated low concentrations of acetone and 2-butanone (MEK) were present in soil, and trace concentrations of 1,1,1-trichloroethane (1,1,1-TCA) were present in groundwater. Acetone had a maximum soil concentration of 220 micrograms per kilogram ($\mu\text{g/kg}$) (220 parts per billion by weight [ppb]). MEK was detected once in soil at a concentration of 36 ppb. 1,1,1-TCA had a maximum concentration of 7.2 micrograms per liter ($\mu\text{g/L}$) (7.2 ppb) in groundwater. FDGTI also detected hydrogen sulfide gas (9 parts per million by volume [ppmv]) and methane (1,000 ppmv) in one soil boring at a depth of 35 feet.

The RWQCB has requested that the City ESD and SeaWorld jointly gauge and sample their respective wells to provide an up-to-date "snapshot" of groundwater elevations and groundwater concentrations. The joint monitoring event occurred in the week of July 9, 2001.

Based on the 1997 groundwater data from eight groundwater monitoring wells in the vicinity of the proposed development, IT concludes that the detectable volatile organic compounds (VOCs) in groundwater are present only at trace concentrations, and the low groundwater VOC concentrations do not indicate a significant human health risk to the proposed development. This conclusion should be re-evaluated after the joint groundwater data are available.

SeaWorld design and engineering staff plan to address soil gas concerns in two ways. First, this soil gas survey will be performed to determine if landfill gas impacts exist in the expansion area, and to determine the nature and extent of detectable soil gas parameters of concern. Second, if soil gas issues are identified, then proper mitigation measures will be designed and incorporated into the grading and construction plans. Soil and soil gas screening will be performed during grading and construction activities to monitor worker health and safety. The work proposed here will accomplish the first measure and allow planning of the second measure.

Soil Vapor Assessment Work Plan

The soil vapor assessment work plan proposed here was designed after four applicable or appropriate references.

- *County of San Diego, 2000. SAM Manual 2000. Prepared by Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) Division. Section 5 of the SAM Manual provide guidance on site assessment techniques for soil gas surveys.*
- *County of San Diego, 2001. Draft Guideline for Laboratory Analysis of Soil Gas Samples. Prepared by DEH SAM, dated May 21. The guideline is intended for use whenever soil gas samples are collected for purposes of a human health risk assessment to be submitted to SAM.*
- *South Coast Air Quality Management District (SCAQMD), 2000. Rule 1150.1. Control of Gaseous Emissions from Municipal Solid Waste Landfills. Rule 1150.1 provides a useful set of rules for monitoring, sampling and analyzing landfill gas.*
- *Los Angeles RWQCB, 1997. Interim Guidance for Active Soil Gas Investigation.*

The LFG parameters of concern include the potential fire/explosive potential of methane and the health risk exposure hazards of hydrogen sulfide and VOCs. The primary LFG components to be evaluated are the following.

Parameters of Concern	
Parameter	Analytical Method
Methane (CH ₄)	Fixed or mobile lab analysis by gas chromatograph (GC) (EPA Method 18) or combustion analysis (EPA Method 25).
Hydrogen sulfide (H ₂ S)	Fixed or mobile lab analysis by sulfur chemiluminescence (SCAQMD Method 307-91) or flame photo ionization detector (FPD) (Air Resources Board [ARB] Method 16).
Volatile organic compounds (VOCs) ^a	Fixed or mobile lab analysis by GC/MS (County of San Diego, 2001).

^a – Benzene, benzyl chloride, chlorobenzene, 1,2-dibromoethane (ethylene dibromide), dichlorobenzene, 1,1-dichloroethane (1,1-DCA), 1,2-DCA, 1,1-dichloroethene (1,1-DCE), cis-1,1-DCE, trans-1,1-DCE, dichloromethane (methylene chloride), tetrachloroethene (PCE), tetrachloromethane (carbon tetrachloride), toluene, 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-TCA, trichloroethene (TCE), trichloromethane (chloroform), vinyl chloride, xylene, Freon 11, Freon 12, and Freon 113.

Additional LFG components shall be collected to evaluate the nature and extent of soil gas conditions.

Parameters of Interest	
Parameter	Analytical Method
Methane (CH ₄)	Field meter analysis by <i>Landtec GEM 500</i> (or equivalent meter) or flame ionization detector (FID) (methods in Rule 1150.1)
Carbon dioxide (CO ₂)	Field meter analysis by <i>Landtec GEM 500</i> (or equivalent meter) (method in Rule 1150.1)
	Fixed or mobile lab analysis by GC (EPA Method 18) or combustion analysis (EPA Method 25).
Oxygen (O ₂)	Field meter analysis by <i>Landtec GEM 500</i> (or equivalent meter) (method in Rule 1150.1)
	Fixed or mobile lab analysis by GC (EPA Method 18) or combustion analysis (EPA Method 25).
Hydrogen sulfide (H ₂ S)	Field meter analysis by <i>Jerome 631X</i> (or equivalent meter)
Total organic compounds (TOC)	Field meter analysis measured as methane by flame ionization detector (FID) (method in Rule 1150.1)
Total non-methane organic compounds (NMOC)	Fixed or mobile lab analysis by GC (EPA Method 18) or combustion analysis (EPA Method 25).

Sample spacing and depth. Active soil vapor samples will be collected from a depth of 5- and 15-feet, from temporary soil vapor probes spaced approximately 100 feet apart, at the approximate locations illustrated in Figure 1. The temporary soil vapor probes will be placed using a truck-mounted hydraulic-drive equipment, and left in place no longer than two to three days. No borings will be advanced below the water table, which is between 10- and 20-feet below grade. Because of the shallow water table, the proposed 15-foot depth of vapor sampling may actually be shallower at some locations.

In this field investigation, no permanent vapor monitoring points will be constructed. The need for permanent vapor sampling probes will be evaluated later, after evaluating the results of this investigation. The LEA may request the City ESD to install permanent LFG monitoring probes on the perimeter of the landfill, in accordance with Division 2, Title 27, which is the combined State Water Resources Control Board/California Integrated Waste Management Board (SWRCB/CIWMB) regulations for solid waste.

Timing. The proximity to Mission Bay makes it likely that there are tidal fluctuations in groundwater. During the period of falling groundwater levels, the soil may intake air from the ground surface. During the period of rising water levels the soil may exhaust soil vapor to the ground surface. In order to detect the highest concentrations, the soil vapor samples will be collected during period of rising tides.

Purging. A minimum of three volumes of vapor will be withdrawn prior to sampling to purge the vapor probe and sampling device of ambient air, and purging will continue until the TOC concentration remains constant for at least 30 seconds. If the soil has insufficient permeability to purge as described above, then a lower volume purge may be necessary.

Reproducibility and Representativeness. All data will be collected and analyzed in a uniform manner to ensure the samples are reproducible and representative.

Sample documentation. Field personnel will document all field activities on Field Activity Daily Logs (FADLs), sample collection logs, and chain-of-custody (COC) forms.

The COC form shall accompany the bag samples. Each time a bag changes hands, it shall be logged on the custody sheet with the time of custody transfer recorded. Laboratory personnel shall record the condition of the sample (full, three-fourths full, one-half full, one-fourth full or empty).

Several of the sample locations will be surveyed to establish ground coordinates to within 0.1 feet horizontal and 0.01 feet vertical. The remaining sample locations will be documented by measuring distances of probes from surveyed points.

Ms. Rebecca Lafreniere

6

July 20, 2001

Sampling and Analysis. All gas probes at each depth shall be monitored for methane, CO₂, O₂ and balance gas (primarily nitrogen) using a *Landtec GEM 500* LFG meter or equivalent meter. At each boring the sample with the highest methane concentration (measured by field meter) will be analyzed for TOC measured as methane using a portable flame ionization detector (FID) meeting the requirements of Section 3.2 of Rule 1150.1.

If the probe TOC concentration exceeds five percent methane, then a vapor sample from that probe will be analyzed at a fixed base lab for methane, H₂S, VOCs, CO₂, O₂ and NMOCs.

If the TOC does not exceed 5% by volume in any of the probes, then bag samples will be collected from the four probes with the highest methane concentration. Those four samples will be analyzed at a fixed base lab for methane, H₂S, VOCs, CO₂, O₂ and NMOCs.

All samples will be analyzed using the methods described in the tables above. Note that the table describes multiple methods for some analyses. To ensure that the sample results are reproducible and comparable, a single method will be selected and used throughout the project.

The bag samples shall be kept in light-sealed containers to avoid photochemical reactions and shall be analyzed no later than 72 hours after collection.

Analyses. The field analyses will be performed in accordance with procedures in Rule 1150.1 and the instrument manufacturer's calibration and operation instructions. The fixed base or mobile laboratory analyses will be performed at a laboratory that is certified by the California Department of Health Services (DOHS) Environmental Laboratory Accreditation Program (ELAP), using the analytical methods listed in the above tables.

Report. IT will prepare a report to describe the field procedures and analytical results. The soil vapor sampling locations will be illustrated on a topographic map drawn to scale. The analytical results will be presented in tabular format and illustrated by means of isopleth maps, as appropriate.

Ms. Rebecca Lafreniere

7

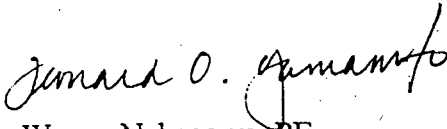
July 20, 2001

We look forward to receiving your review comments by August 3, 2001. If you have any questions, please call Tom Mulder at 619.533.7302.

Sincerely,
IT Corporation



Thomas J. Mulder, RG, CEG, CHG
Project Manager


FOR Wayne Nakagawa, PE
Chemical Engineer

TJM:kae

enclosures Figure 1, Site Plan and Proposed Soil Vapor Survey Sample Location

c: Craig Carlisle, RWQCB
John Odermatt, RWQCB
Robert Ferrier, City ESD
Chris Gonaver, City ESD
George Morton, City ESD
Ray Purtee, City ESD
Diana Buchanan, IT Corp
Patrick Owen, SeaWorld
Greg Gourley, Sea World
Kevin Carr, SeaWorld
David Watson, Gray Cary
Robert Longstreth, Gray Cary
TJM/KSR/WN/JD/file/chron

DRAWING 828286-B1
 DRAWN BY: DM 06/23/01
 CHECKED BY: JN 7/20/01
 APPROVED BY: JN 7/20/01

MISSION BAY

PROPOSED TIER 1 PROJECT
 SPLASHDOWN RIDE

LEGEND:

- MBW-2 CITY ESD GROUNDWATER MONITORING WELL
- LE-2 SEA WORLD GROUNDWATER MONITORING WELL
- WA-1 ABANDONED GROUNDWATER MONITORING WELL
- PROPOSED SOIL VAPOR SAMPLING LOCATION

NOTE:

BASE MAP PROVIDED BY PGAV, INC. LAND SURVEY DATA REPORTED TO BE FROM HALE ENGINEERING SURVEYED AUGUST, 2000

UTILITY NOTE:

UNDERGROUND UTILITY LINES SHOWN ON THIS PLAN ARE DERIVED FROM RECORDS OF INFORMATION PROVIDED BY SEA WORLD. LOCATION OF SURFACE FEATURES AND THEIR GRADES ARE ACTUAL LOCATIONS. LOCATION OF UNDERGROUND UTILITIES MUST BE VERIFIED PRIOR TO CONSTRUCTION.

BENCHMARK:

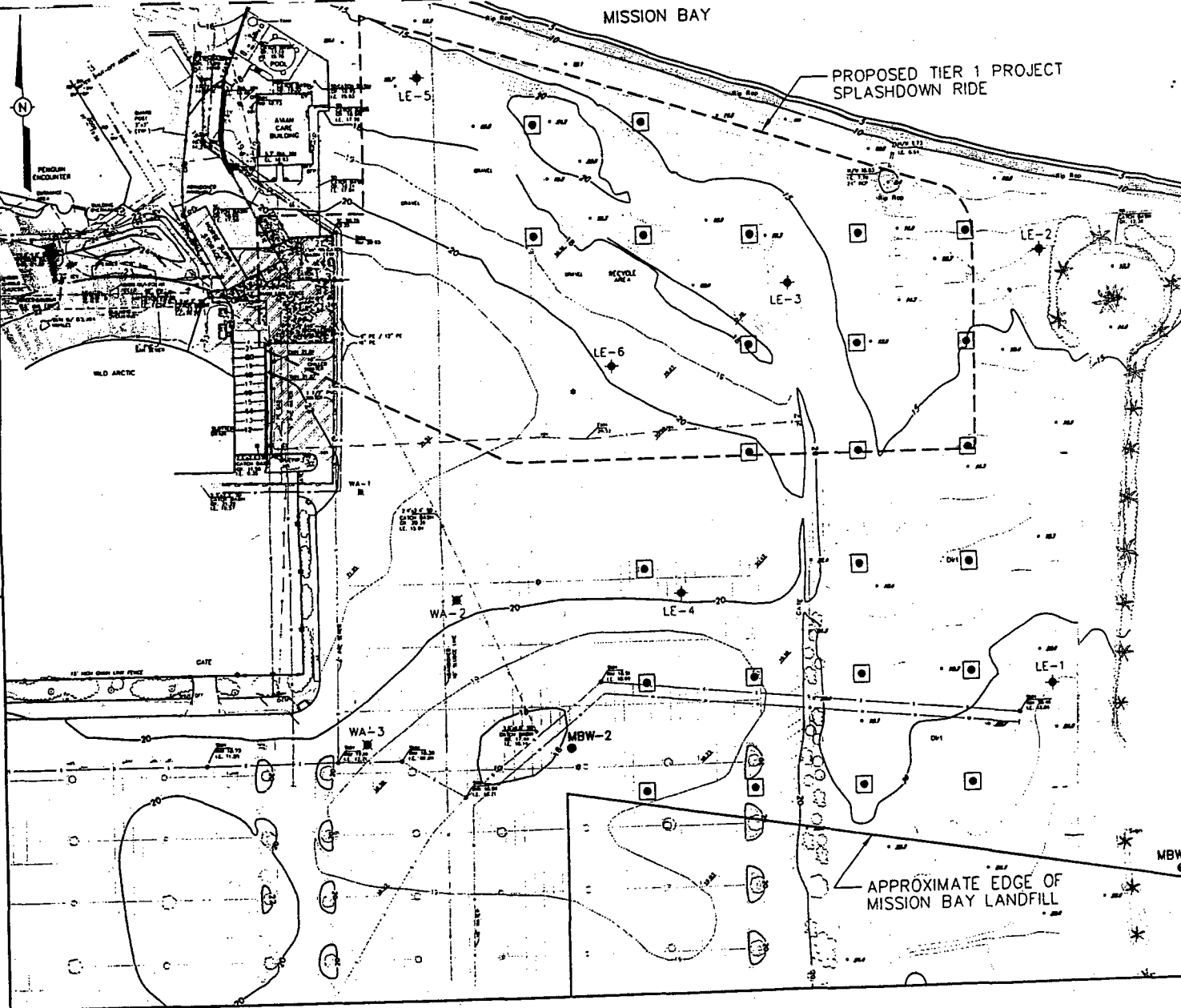
ELEVATIONS SHOWN ON THIS PLAN ARE ON "SEA WORLD DATUM" (SWD). MEAN SEA LEVEL PER CITY OF SAN DIEGO IS REFERENCED AS FOLLOWS: CITY OF SAN DIEGO ENGINEER'S BRASS DISK IN THE NORTHWEST CORNER OF CONCRETE BOAT RAMP AT SOUTH SHORES PARK. ELEVATION 6.68 MSL = 9.82 SWD

SCALE
 0 90 180 FEET



SEA WORLD
 404 SEA WORLD DRIVE
 SAN DIEGO, CALIFORNIA

FIGURE 1
SITE PLAN AND
PROPOSED SOIL VAPOR SURVEY
SAMPLE LOCATION



Mulder, Tom

From: Ray Purtee [RYP@sdcity.sannet.gov]
Sent: Friday, August 03, 2001 3:56 PM
To: tmulder@theitgroup.com
Subject: Soil Vapor Assessment Workplan

Our only comment to the workplan is to the third paragraph of page 2: since 1962 there has been additional cover material placed on the site in question. Without doing research, I cannot quantify how much additional cover has been placed. The point I'm making is that the area has not sat untended since 1962.



CITY OF SAN DIEGO SOLID WASTE LOCAL ENFORCEMENT AGENCY (LEA)
1222 First Avenue, MS 501 • San Diego, CA 92101-4155 • Tel (619) 446-5002 • Fax (619) 446-5001

August 24, 2001

Mr. Thomas Mulder, Project Manager
IT Corporation
1230 Columbia Street, Suite 1200
San Diego, CA 92101-8517

Faxed: 619-239-1238

Dear Mr. Mulder:

Subject: Work Plan for Soil Vapor Assessment, Sea World Expansion Plan, 16-Acre Tract

Per our telephone conversation earlier this month, the City of San Diego Solid Waste Local Enforcement Agency (LEA) has reviewed the proposed Sea World Soil Vapor Assessment Work Plan. To better assess the site in respect to potential landfill influences, the western end and northwest end of the landfill requires additional sampling locations. The LEA is requesting that a minimum of four additional sampling locations be added to the proposal to address these areas. Please submit a revised sampling location map identifying the new sampling locations.

Should you have any questions or would like to discuss this further, please contact me at (619) 446-5005.

Sincerely,

Rebecca Lafreniere
Rebecca Lafreniere
Solid Waste Inspector III

Cc: John Odermatt, RWQCB
Robert Ferrier, City ESD
Ray Purtee, City ESD
Patrick Owen, Sea World
Kevin Carr, Sea World



IT Corporation
1230 Columbia Street, Suite 1200
San Diego, CA 92101-8517
Tel. 619.239.1690
Fax. 619.239.1238

A Member of The IT Group

October 18, 2001

IT Corporation Project 830418

Ms. Rebecca Lafreniere
Solid Waste Local Enforcement Agency
City of San Diego
1222 First Avenue, MS 501
San Diego, CA 92101-4155

Work Plan for Soil Vapor Assessment
Response to LEA Comments
SeaWorld Expansion Plan, 16-Acre Tract

Dear Ms. Lafreniere:

In response to your comments of August 24, 2001, IT Corporation (IT) has added four soil vapor probe locations to the Work Plan for Soil Vapor Assessment. The four additional locations will be on the west and northwest side of the landfill. Enclosed is a revised site plan that shows all twenty-eight proposed vapor probe locations.

IT plans to begin the field work on October 22, and anticipates completing the field work by October 31, 2001.

If you have any questions, please call Tom Mulder at 619.533.7302.

Sincerely,
IT Corporation

A handwritten signature in black ink, appearing to be 'TJ Mulder', with a long horizontal line extending to the right.

Thomas J. Mulder, RG, CEG, CHG
Project Manager
TJM:kae

enclosure

c: Craig Carlisle, RWQCB
John Odermatt, RWQCB
Robert Ferrier, City ESD
Ray Purtee, City ESD
Patrick Owen, SeaWorld
Greg Gourley, Sea World
Kevin Carr, SeaWorld
Robert Longstreth, Gray Cary
TJM/KSR/WN/JD/file/chron

DRAWING
NUMBER

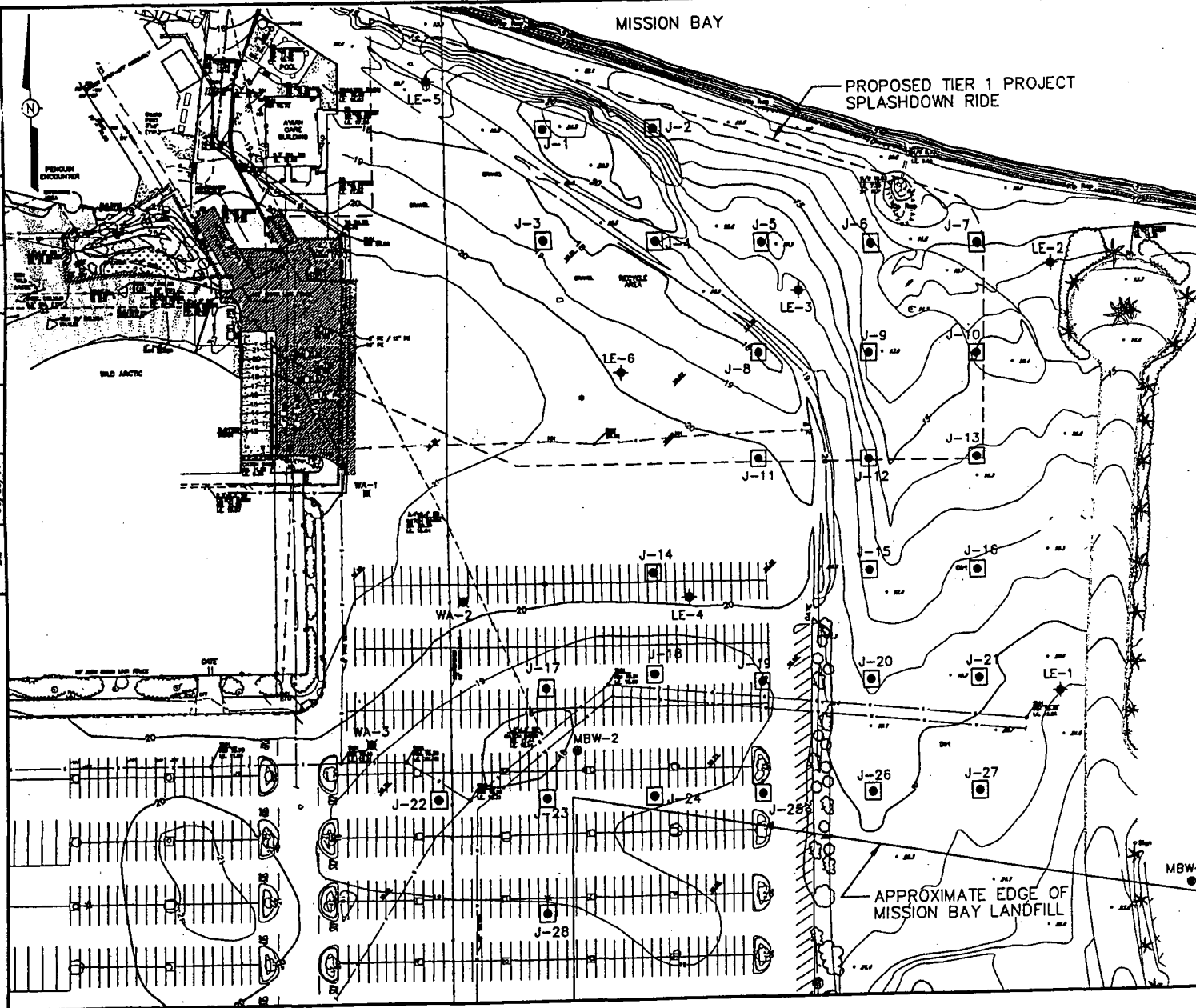
**DRAWING
NUMBER**

APPROVED BY	
-------------	--

CHECKED BY

DATE	08/25/01
DRAWN BY	

7



WBW-2
② CITY ESD GROUNDWATER MONITORING WELL

LE-2
◆ SEA WORLD GROUNDWATER MONITORING WELL

WA-1
■ ABANDONED GROUNDWATER MONITORING WELL

J-3
● PROPOSED SOIL VAPOR SAMPLING LOCATION

NOTE:

BASE MAP PROVIDED BY PGAV, INC. LAND SURVEY
DATA REPORTED TO BE FROM HALE ENGINEERING
SURVEYED AUGUST, 2000

UTILITY NOTE:

UNDERGROUND UTILITY LINES SHOWN ON THIS PLAN ARE DERIVED FROM RECORDS OF INFORMATION PROVIDED BY SEA WORLD. LOCATION OF SURFACE FEATURES AND THEIR GRADES ARE ACTUAL LOCATIONS. LOCATION OF UNDERGROUND UTILITIES MUST BE VERIFIED PRIOR TO CONSTRUCTION.

BENCHMARK:

ELEVATIONS SHOWN ON THIS PLAN ARE ON "SEA WORLD DATUM" (SWD). MEAN SEA LEVEL PER CITY OF SAN DIEGO IS REFERENCED AS FOLLOWS: CITY OF SAN DIEGO ENGINEER'S BRASS DISK IN THE NORTHWEST CORNER OF CONCRETE BOAT RAMP AT SOUTH SHORES PARK.
ELEVATION 6.68 MSL = 9.82 SWD

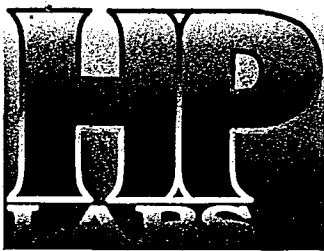
0 90 180 FEET



SEAWORLD
500 SEAWORLD DRIVE
SAN DIEGO, CALIFORNIA

FIGURE 1,
SITE PLAN AND FINAL
PROPOSED SOIL VAPOR SURVEY
SAMPLE LOCATION

APPENDIX B
LABORATORY ANALYTICAL REPORT AND CHAIN-OF-CUSTODY



11/9/01

IT Corporation
1230 Columbia Street, Suite 1200
San Diego, CA 92101

Project Name: Sea World
Project No.:

Attention: Mr. Tom Mulder

The following sample(s) were received and analyzed:

<u>Date Received</u>	<u>Quantity</u>	<u>Matrix</u>
10/26/01	5	Vapor

The samples were analyzed by one or more of the EPA methodologies or equivalent methods listed below.

VOCs -- EPA Method 8260

The results are included with a summary of the quality control procedures. Please note that the symbol "nd" indicates a value below the reporting limit for the particular compound in the sample.

Please feel free to call us to discuss any part of this report or to schedule future projects.

Sincerely,


Tamara Davis
Lab Director

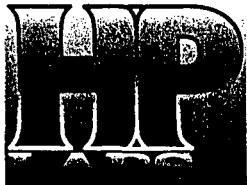
Mobile One Laboratories is certified by the California Department of Health Services (certificate #s: 1194, 1561, 1921, 2088, 2278).

HP Labs Project # IT102601-10

148 S. Vinewood Street • Escondido, CA 92029 • Phone (760) 735-3208 • Fax (760) 735-2469
432 N. Cedros Avenue • Solana Beach, CA 92075 • Phone (858) 793-0401 • Fax (858) 793-0404
2373 208th Street Suite F-1 • Torrance, CA 90501 • Phone (310) 782-2929 • Fax (310) 782-2798

Report Summary

Narrative

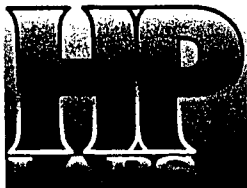


Client: IT Corporation
Project: Sea World

Matrix: vapor
Units: ug/L

Date Analyzed: October 26, 2001

Since the analysis of benzyl chloride was requested for these samples and it is a compound not normally associated with the EPA Method 8260 calibration, it was searched as a tentatively identified compound (TIC). Each sample chromatogram was searched for the three ions associated with benzyl chloride (from the NSIT Library). Benzyl chloride was not identified in any of the samples.



Report Summary

EPA Method 8260B (5030 Prep.)

Client: IT Corporation
Project: Sea World

Matrix: vapor
Units: ug/L

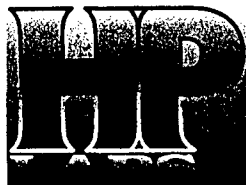
Sample Name:	J-2 s	J-14 d	J-21 s	J-24 d	J-28 s	Method Blank
Analysis Date	26 Oct 2001	26 Oct 2001	26 Oct 2001	26 Oct 2001	26 Oct 2001	26 Oct 2001
Analysis Time	12:43 pm	1:27 pm	1:05 pm	2:31 pm	2:07 pm	11:40 am
Dilution Factor:	0.05	0.05	0.05	0.05	0.05	0.05

Compound	E.O.L	Amount Found	Amount Found	Amount Found	Amount Found	Amount Found	Amount Found
Dichlorodifluoromethane	1	nd	nd	nd	nd	nd	nd
Vinyl Chloride	1	nd	nd	nd	nd	nd	nd
Trichlorofluoromethane	1	nd	nd	nd	nd	nd	nd
1,1-Dichloroethene	1	nd	nd	nd	nd	nd	nd
Methylene Chloride	1	nd	nd	nd	nd	nd	nd
Freon-113	1	nd	nd	nd	nd	nd	nd
trans-1,2-Dichloroethene	1	nd	nd	nd	nd	nd	nd
1,1-Dichloroethane	1	nd	nd	nd	nd	nd	nd
cis-1,2-Dichloroethene	1	nd	nd	nd	nd	nd	nd
Chloroform	1	nd	nd	nd	nd	nd	nd
1,1,1-Trichloroethane	1	nd	nd	nd	nd	nd	nd
Carbon Tetrachloride	1	nd	nd	nd	nd	nd	nd
1,2-Dichloroethane	1	nd	nd	nd	nd	nd	nd
Benzene	1	nd	nd	nd	nd	nd	nd
Trichloroethene	1	nd	nd	nd	nd	nd	nd
Toluene	1	nd	nd	nd	nd	nd	nd
1,1,2-Trichloroethane	1	nd	nd	nd	nd	nd	nd
1,2-Dibromoethane	1	nd	nd	nd	nd	nd	nd
Tetrachloroethene	1	nd	nd	nd	nd	nd	nd
Chlorobenzene	1	nd	nd	nd	nd	nd	nd
m,p-Xylene	1	nd	nd	nd	nd	nd	nd
o-Xylene	1	nd	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	1	nd	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	1	nd	nd	nd	nd	nd	nd
Surrogates	Spiked	QC Limits(% Rec.)		Percent Recovery			
DBFM	50 ng	75-125	98	106	102	102	99
1,2-DCA-d4	50 ng	70-130	99	104	100	98	96
Toluene - d8	50 ng	75-125	92	96	99	96	95
1,4-BFB	50 ng	75-125	89	94	90	91	89

Analyses performed by: Mark Lathrop

Calibration Verification

EPA Method 8260B



Client: IT Corporation
Project: Sea World

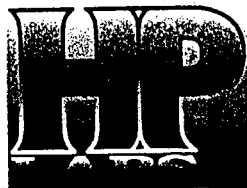
Matrix: vapor
Units: ug/L

Sample Name: CCV
Analysis Date: 26 Oct 2001
Analysis Time: 11:08 am
Dilution Factor: 1

Compound	Amount Found	Percent Diff	CCC	EPA 8260
			(-20 to +20%) Pass	(-20 to +20%) Pass
Dichlorodifluoromethane	58	16		yes
Chloromethane	55	9		yes
Vinyl Chloride	CCC 57	14	yes	yes
Bromomethane	61	22		no
Chloroethane	59	18		yes
Trichlorofluoromethane	59	19		yes
1,1-Dichloroethene	CCC 50	1	yes	yes
Methylene Chloride	49	-3		yes
Freon-113	40	-20		no
trans-1,2-Dichloroethene	50	0		yes
1,1-Dichloroethane	54	8		yes
2,2-Dichloropropane	54	8		yes
cis-1,2-Dichloroethene	50	0		yes
Chloroform	CCC 53	6	yes	yes
Bromochloromethane	50	0		yes
1,1,1-Trichloroethane	51	2		yes
1,1-Dichloropropene	53	5		yes
Carbon Tetrachloride	51	3		yes
1,2-Dichloroethane	55	10		yes
Benzene	53	7		yes
Trichloroethene	51	1		yes
1,2-Dichloropropane	CCC 50	1	yes	yes
Bromodichloromethane	51	1		yes
Dibromomethane	51	2		yes
cis-1,3-Dichloropropene	49	-2		yes
Toluene	CCC 48	-4	yes	yes
trans-1,3-Dichloropropene	50	-1		yes
1,1,2-Trichloroethane	49	-2		yes
1,2-Dibromoethane	48	-3		yes
1,3-Dichloropropane	49	-1		yes

Calibration Verification

EPA Method 8260B



Client: IT Corporation
Project: Sea World

Matrix: vapor
Units: ug/L

EPA 8260
(-20 to +20%)

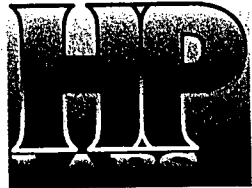
Sample Name:		CCV		Pass
Compound		Amount Found	Percent Diff	
Tetrachloroethene		47	-6	yes
Dibromochloromethane		46	-8	yes
Chlorobenzene		51	1	yes
Ethylbenzene	CCC	50	0	yes
1,1,1,2-Tetrachloroethane		53	5	yes
m,p-Xylene		101	1	yes
o-Xylene		50	0	yes
Styrene		50	0	yes
Bromoform		46	-8	yes
Isopropylbenzene		52	4	yes
1,1,2,2-Tetrachloroethane		48	-4	yes
1,2,3-Trichloropropane		47	-5	yes
n-propylbenzene		56	11	yes
Bromobenzene		51	2	yes
1,3,5-Trimethylbenzene		52	4	yes
2-Chlorotoluene		53	6	yes
4-Chlorotoluene		51	2	yes
tert-Butylbenzene		51	2	yes
1,2,4-Trimethylbenzene		52	3	yes
sec-Butylbenzene		51	2	yes
p-Isopropyltoluene		50	0	yes
1,3-Dichlorobenzene		49	-2	yes
1,4-Dichlorobenzene		48	-3	yes
n-Butylbenzene		53	7	yes
1,2-Dichlorobenzene		49	-3	yes
1,2-Dibromo-3-chloropropane		46	-8	yes
1,2,4-Trichlorobenzene		47	-7	yes
Hexachlorobutadiene		47	-6	yes
Naphthalene		41	-19	yes
1,2,3-Trichlorobenzene		44	-12	yes

SUMMATION

CCC compounds pass the 8260B criteria

Surrogates	Spiked	QC Limits(% Rec.)	
DBFM	50 ng	75-125	103
1,2-DCA-d4	50 ng	70-130	104
Toluene - d8	50 ng	75-125	97
1,4-BFB	50 ng	75-125	92

CALIBRATION VERIFIED



Footnote Summary

Footnote

Definition

E.Q.L.	Estimated Quantitation Limit
nd	Not detected above the E.Q.L. or detection limit.
J	The concentration reported is between the Method Detection Limit and the E.Q.L.
D	Concentration reported from a secondary dilution; E.Q.L.s adjusted accordingly.
B	Analyte found in the associated blank.
E	Analyte amount exceeds calibration range. Amount quantitated by extrapolation.
***	MS/MSD, LCS/LCSD recovery is outside QC range; no corrective action taken.
M	Surrogate recovery outside QC range due to matrix interference.
S	Because of necessary sample dilution, value was outside QC limits.
&	Gasoline range organics not identified as gasoline.
#	Diesel range organics not identified as diesel.
**	This compound has been screened by EPA method 8020. Any positive results should be confirmed by a second analysis.



INTERNATIONAL
TECHNOLOGY
CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD *

Reference Document No. 514597

Page 1 of 1

Project Name/No. ¹ SeaWorld
Sample Team Members ² J. DeWoody / S. Ceniga
Profit Center No. ³ /
Project Manager ⁴ Tom Mulder
Purchase Order No. ⁶ 181761 OP
Required Report Date ¹¹ 10/30/01

Samples Shipment Date ⁷ 10/25/01
Lab Destination ⁸ HP Lab
Lab Contact ⁹ Blayne H.
Project Contact/Phone ¹² Tom Mulder 619-533-7302
Carrier/Waybill No. ¹³ Fed ex

Bill to: ⁵ IT Corp.
San Diego
Report to: ¹⁰ IT Corp.
1230 Columbia St. Ste 1200
San Diego CA 92101
fax 619-239-1238

ONE CONTAINER PER LINE

Sample ¹⁴ Number	Sample ¹⁵ Description/Type	Date/Time ¹⁶ Collected	Container ¹⁷ Type	Sample ¹⁸ Volume	Pre- ¹⁹ servative	Requested Testing ²⁰ Program	Condition on ²¹ Receipt	Disposal ²² Record No.
J-2 S	Air	10/25/01 0650	1 L Tedlar bag		Dark	VOCs by GC/MS SD County-2001 GC/MS		
J-14 d		10/25/01 0730						
J-21 S		10/25/01 0655						
J-28 S		10/25/01 0710						
J-24 d		10/25/01 0725						

Special Instructions: ²³

Possible Hazard Identification: ²⁴

Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: ²⁵

Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required: ²⁶

Normal ☐ Rush ☒

QC Level: ²⁷

I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by ²⁸
(Signature/Affiliation)

Date: 10/25/01
Time: 1500

1. Received by ²⁸
(Signature/Affiliation)

Date: _____
Time: _____

2. Relinquished by
(Signature/Affiliation)

Date: _____
Time: _____

2. Received by
(Signature/Affiliation)

Date: _____
Time: _____

3. Relinquished by
(Signature/Affiliation)

Date: _____
Time: _____

3. Received by
(Signature/Affiliation)

Date: _____
Time: _____

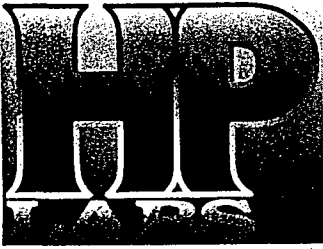
Comments: ²⁹

Analyze and report VOCs on attached list - by GC/MS

Benzene, benzyl chloride, chlorobenzene, 1,2-dibromoethane (ethylene dibromide), dichlorobenzene, 1,1-dichloroethane (1,1-DCA), 1,2-DCA, 1,1-dichloroethene (1,1-DCE), cis-1,2-DCE, trans-1,2-DCE, dichloromethane (methylene chloride), tetrachloroethene (PCE), tetrachloromethane (carbon tetrachloride), toluene, 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2-TCA, trichloroethene (TCE), trichloromethane (chloroform), vinyl chloride, xylene, Freon 11, Freon 12, and Freon 113

Analyzer + Report above VOCs

COC # 514597 10/25/01



Monday, November 19, 2001

Tom Mulder
IT Corporation
1230 Columbia Street, Suite 1200
San Diego, CA 92101-8517

Dear Mr. Mulder:

This letter is in regards to the chain of custody for project number 181761 OP at Sea World (see copy enclosed). It has come to our attention the chain of custody was not signed "received" by HP Labs. These sample were indeed received by us via Fed Ex on 10/25/01. They arrived at our lab on 10/26/01 at 9:45 Am, and were analyzed that same day. Please except our apologies for this oversight. If there is anything we can do to help further please call us.

Sincerely,

A handwritten signature in cursive script, reading "Louise Adams". The signature is written in black ink and is positioned above the printed name and title.

Louise Adams
Operations Manager



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD *

Reference Document No. 51459
Page 1 of 1

Project Name/No. 1 SeaWorld
Sample Team Members 2 J. DeWoody / S. Caniga
Profit Center No. 3
Project Manager 4 Tom Mulder
Purchase Order No. 6 181761 OP
Required Report Date 11 10/30/01

Samples Shipment Date 7 10/25/01
Lab Destination 8 HP Lab
Lab Contact 9 Blayne H.
Project Contact/Phone 12 Tom Mulder 619-533-7302
Carrier/Waybill No. 13 Fed ex

Bill to: 5 IT Corp.
San Diego
Report to: 10 IT Corp.
1230 Columbia St. Ste 1200
San Diego CA 92101
Fax 619-239-1238

ONE CONTAINER PER LINE

Sample ¹⁴ Number	Sample ¹⁵ Description/Type	Date/Time ¹⁶ Collected	Container ¹⁷ Type	Sample ¹⁸ Volume	Pre- ¹⁹ servative	Requested Testing ²⁰ Program	Condition on ²¹ Receipt	Disposal ²² Record No.
J-2 S	Air	10/25/01 0650	1L redlar bag		Dark	VOCs by GC/MS SD County 2001 GC/MS		
J-14 d		10/25/01 0730					FOR LAB USE ONLY	
J-21 S		10/25/01 0655						
J-28 S		10/25/01 0710						
J-24 d		10/25/01 0725					FOR LAB USE ONLY	

Special Instructions: ²³

Possible Hazard Identification: ²⁴

Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal: ²⁵

Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required: ²⁶

Normal ☐ Rush ☒

QC Level: ²⁷

I. ☐ II. ☐ III. ☐

Project Specific (specify): _____

1. Relinquished by: ²⁸
(Signature/Affiliation) Sarah Caniga

Date: 10/25/01
Time: 1500

1. Received by ²⁸
(Signature/Affiliation)

Date: _____
Time: _____

2. Relinquished by
(Signature/Affiliation)

Date: _____
Time: _____

2. Received by
(Signature/Affiliation)

Date: _____
Time: _____

3. Relinquished by
(Signature/Affiliation)

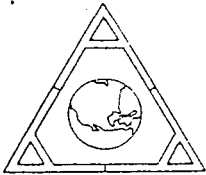
Date: _____
Time: _____

3. Received by
(Signature/Affiliation)

Date: _____
Time: _____

Comments: ²⁹

Analyze and report VOCs on attached list -- by GC/MS



AtmAA Inc.

23917 Craftsman Rd., Calabasas, CA 91302 • (818) 223-3277 • FAX (818) 223-8250

environmental consultants
laboratory services

October 31, 2001

LTR/582/01

Tom Mulder
IT Corp.
1230 Columbia St., Ste. 1200
San Diego, CA 92101

re: Sea World (P.O. No.: 181760 OP)

Dear Tom:

Please find enclosed the laboratory analysis report, quality assurance summary, and the original chain of custody form for five Tedlar bag samples received October 26, 2001.

The samples were analyzed for permanent gases, hydrogen sulfide, and total gaseous non-methane organics (TGNMO) as requested on the chain of custody form.

Sincerely,

AtmAA, Inc.

Michael L. Porter
Laboratory Director

Encl.
MLP/bwf



AtmAA Inc.

23917 Craftsman Rd., Calabasas, CA 91302 • (818) 223-3277 • FAX (818) 223-8250

environmental consultants
laboratory services

LABORATORY ANALYSIS REPORT

Permanent Gases, Hydrogen Sulfide, and Total Gaseous Non- Methane
Organics (TGNMO) Analysis in Tedlar Bag Samples

Report Date: October 31, 2001
Client: IT Corp.
Project Location: Sea World
Client P.O. No.: 181760 OP
Date Received: October 26, 2001
Date Analyzed: October 26, 2001

ANALYSIS DESCRIPTION

Permanent gases were measured by thermal conductivity detection/gas chromatography (TCD/GC). Hydrogen sulfide was analyzed by gas chromatography with a Hall electrolytic conductivity detector operated in the oxidative sulfur mode. Total gaseous non-methane organics (TGNMO) was measured by flame ionization detection/total combustion analysis (FID/TCA), EPA Method 25 analysis.

AtmAA Lab No.:	02991-1	02991-2	02991-3	02991-4	02991-5
Sample I.D.:	J-2s	J-14d	J-21s	J-28s	J-24d

Components

(Concentration in %,v)

Nitrogen	75.5	76.4	53.5	65.2	60.2
Oxygen	16.2	17.8	9.56	11.3	16.0
Methane	0.43	3.17	21.6	8.97	13.1
Carbon dioxide	7.51	2.95	15.6	14.9	10.9

(Concentration in ppmv)

Hydrogen sulfide	<0.3	0.47	9.41	<0.3	1820
Ethane	<1	4.97	14.4	3.46	7.55
TGNMO	4.02	27.3	60.7	132	78.0

The reported oxygen concentration includes any argon present in the sample. Calibration is based on a standard atmosphere containing 20.95% oxygen and 0.93% argon. The accuracy of permanent gas analysis by TCD/GC is +/- 2%, actual results are reported. TGNMO is total gaseous non-methane organics (excluding ethane) measured and reported as ppm methane.

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analyses)

Project Location: Sea World
Date Received: October 26, 2001
Date Analyzed: October 26, 2001

Components	Sample ID	Repeat Analysis		Mean Conc.	% Diff. From Mean
		Run #1	Run #2		
		(Concentration in %,v)			
Nitrogen	J-2s	75.4	75.6	75.5	0.13
	J-21s	53.4	53.6	53.5	0.19
Oxygen	J-2s	16.1	16.2	16.2	0.31
	J-21s	9.54	9.58	9.56	0.21
Methane	J-2s	0.43	0.43	0.43	0.0
	J-21s	21.5	21.7	21.6	0.46
Carbon dioxide	J-2s	7.47	7.55	7.51	0.53
	J-21s	15.5	15.7	15.6	0.64
(Concentration in ppmv)					
Hydrogen sulfide	J-2s	<0.3	<0.3	---	---
	J-14d	0.46	0.48	0.47	2.1
	J-21s	9.28	9.54	9.41	1.4
	J-28s	<0.3	<0.3	---	---
	J-24d	1800	1840	1820	1.1
TGNMO	J-2s	4.03	4.02	4.02	0.12
	J-21s	59.5	61.9	60.7	2.0

Five Tedlar bag samples, laboratory numbers 02991-(1-5), were analyzed for permanent gases, hydrogen sulfide, and TGNMO. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean". Repeat analyses are an important part of AtmAA's quality assurance program. The average % Difference from Mean for 13 repeat measurements from the five Tedlar bag samples is 0.71%.



**ANALYSIS REQUEST AND
CHAIN OF CUSTODY RECORD***

Reference Document No. 514599
Page 1 of 1

Project Name/No. 1 SeaWorld
Sample Team Members 2 J. Dewoody / S. Ceniga
Profit Center No. 3 /
Project Manager 4 Tom Mulder
Purchase Order No. 6 181760 OP
Required Report Date 11 10/30/01

Samples Shipment Date 7 10/25/01
Lab Destination 8 Atmaa
Lab Contact 9 Mike Porter
Project Contact/Phone 12 Tom Mulder 619-533-7302
Carrier/Waybill No. 13 FedEx

Bill to: 5 IT Corp
San Diego
10 IT Corp
1230 Columbia St. Ste 1200
San Diego CA 92101
fax 619-239-1238
ONE CONTAINER PER LINE

Sample Number ¹⁴	Sample Description/Type ¹⁵	Date/Time Collected ¹⁶	Container Type ¹⁷	Sample Volume ¹⁸	Pre-servative ¹⁹	Requested Testing Program ²⁰	Condition on Receipt ²¹	Disposal Record No. ²²
J-2 s	Air	10/25/01 0650	1L Tedlar bag		Dark	CH ₄ , H ₂ S, CO ₂ , O ₂ , N ₂ NMOC's		Lab# -1
J-14 d		10/25/01 0730						02991-2
J-21 s		10/25/01 0655						3
J-28 s		10/25/01 0710						4
J-24 d		10/25/01 0725						5

Special Instructions: ²³
Possible Hazard Identification: ²⁴

Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒
Sample Disposal: ²⁵

Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required: ²⁶

Normal ☐ Rush ☒
QC Level: ²⁷

I. ☐ II. ☐ III. ☐

Project Specific (specify): _____

1. Relinquished by ²⁸ Sarah Ceniga
(Signature/Affiliation)

Date: 10/25/01
Time: 1500

1. Received by ²⁸
(Signature/Affiliation)

Date: _____
Time: _____

2. Relinquished by
(Signature/Affiliation)

Date: _____
Time: _____

2. Received by
(Signature/Affiliation) Mike Porter

Date: 10/26/01
Time: 1000

3. Relinquished by
(Signature/Affiliation)

Date: _____
Time: _____

3. Received by
(Signature/Affiliation)

Date: _____
Time: _____

Comments: ²⁹

Write: To accompany samples

Yellow: Field copy

* See back of form for special instructions

Director
Department of Toxic Substances Control
The State of California
2878 Camino Del Rio South
Suite Number 402
San Diego, CA 92108-3847

May 15, 2003

Re: Urgent Request for Risk Assessment at the Work Site of the Construction for the SplashDown Thrill Ride and the J-24 well site in the Guest Parking Lot at SeaWorld in Mission Bay (State) Park in San Diego, Ca.

Dear Director:

We recently received a document which suggests the high likelihood of imminent danger to the public in the immediate vicinity of the SeaWorld construction site at the Splashdown Ride foundation area and in the guest parking lot. We are urging your office to assess this danger and to take all steps necessary to protect construction workers, SeaWorld employees, and the public from lethal concentrations of hydrogen sulfide (H₂S) located within the visitor's parking lot and adjacent public areas approximately 10-15 feet below the surface level.

The Coastal Commission issued a permit to construct the Ride which contained mitigation measures that included a mandate for the leasehold tenant, SeaWorld, to dig test holes at the actual construction site, prior to beginning the foundation work in earnest. We believe the test holes were not performed at the site of the construction. Note: The site was changed by the Coastal Commission after holes were drilled at the proposed site in the permit application. The specific mitigation measures ordered were "complete subsurface geotechnical investigations to evaluate the hydraulic fill materials and bay deposits at the site." The City has not provided us documentary evidence that the requirement was satisfied. (Refer to our letter enclosed at #1).

Further, we believe that the contaminated soil excavated from the construction site, was transported to a City landfill without testing or permit. No documentation or soil certification was required by the City when the soil was deposited in the landfill. This may have resulted in the contamination of a distant landfill and posed incumbent risks to landfill workers.

Recently, a confidential informant provided us a technical report issued to the City in January 2002, entitled: **"Results of Soil Vapor Assessment SeaWorld Expansion Plan, 16-Acre Tract."** (Refer to enclosure #2). The tract in question is the site of a proposed parking lot and not the Ride. We believe that the plume of toxins is migrating toward the Ride. (Refer to enclosure #3). On May 7, 2003, the Coastal Commission denied the permit for the proposed parking lot in order to allow time for, among other things, further site study for the toxins.

The report contents are startling! Among other things, they indicate a triple checked **detection of over 1,800 parts per million (ppm) of hydrogen sulfide (H₂S) gas in a test well (well J-24) within the current Seaworld guest parking lot. The location is about half the distance from a boat ramp and the Ride. (Refer to enclosures #4)**

encl 2

As indicated in the "Hazardous Materials, Substances & Wastes Compliance Guide" including "Emergency Response Guidebook", the applicable passages indicate a hazard for H2S when in concentrations more than 1 PPM, a extreme hazard at 10 PPM and a potentially lethal concentration at 100 PPM. (Refer to enclosure #5).

Although this report has been in the hands of the City of San Diego for more than sixteen months, its existence has never been revealed to persons other than city staff. For this reason, we can not rely on the City or SeaWorld to "do the right thing" and take proactive precautions. Therefore, we must refer this matter to a State office in order for our concerns to be promptly and appropriately addressed.

Regrettably, in 1988, eight workman were injured and one died digging a foundation for the boat launch ramp located approximately 225 yards from where the Ride is now being constructed. (Refer to Enclosure #6). The Emergency Response Guide states that the minimum safe distance for a concentration of 10 PPM is 330 to 660 feet.

This is ongoing construction, in the middle of an open theme park located in a State Park, with known toxic waste buried beneath the ground and construction and excavations in progress. This unsafe practice is what we are urging you to explore and curtail, as the State of California deems necessary.

As you know, this site in question was largely formed by dredge soils. Therefore, it is highly unstable and in the event of an earthquake from nearby Rose Canyon Fault or the Mission Beach Fault, the soil is likely to be unstable. Any concentration of gas under pressure could be released into the atmosphere. Secondly, much of the bay bottom sub-soils are clay. The clay is subject to liquefaction and shifting which could also result in venting of pressurized, hazardous vapors into the atmosphere.

With regard to the test well (J-24) in the current visitor parking lot, we believe an accident or an incident of vandalism could result in the release of the documented 1,800 ppm concentration of lethal gas. Further, as the asphalt surface acts as a "poor man's cap" the gases emanating from either the former solid waste dump or the former toxic waste dump may accumulate, migrate laterally, and naturally escape into the atmosphere at any time and place. Clearly, this is not a mechanism that should be operating in a public parking lot with children present.

We urge you to use your investigative powers and special authorities to immediately explore these issues, clarify the situation, and intervene as appropriate. We counsel use of the Precautionary Principal in this issue of public health and safety.

We appreciate your prompt attention to this urgent matter of public safety.

If we may be of service to you or your staff, we may be reached at: John Wilks (619) 671-8227 (Day) (619) 426-4776 (Night) or Scott Andrews (619) 544-6816).

Respectfully,



John E. Wilks, III
as individuals and concerned citizens



Scott Andrews

CF
CA State OSHA

Enclosures

1. Letter, 05/08/03, Subj.: Compliance with SWAP Mitigation.
2. Study, 01/02, Subj: Results of Soil Vapor Assessment SWAP.
3. Letter, 02/12/03, Subj: Proposed Dewatering Operation of Wild Artic
4. Map, Fig. 4.11-1 (Boat Launch & environs).
5. Guidebook, page 198 H2S
6. News Article, 1989. Tribune.

SUBSTANCES REPORTED IN DETECTABLE QUANTITIES AT MISSION BAY LANDFILL
BY WOODWARD-CLYDE CONSULTANTS SITE ASSESSMENT REPORT - NOVEMBER 1983

Asterisk (*) indicates substances named as "EPA Priority Pollutant" in 1983

LANDFILL SOIL COVER

Phenol and Selected Anions:

Phenol*, Sulfide, Flouride

Metals:

Arsenic*, Barium, Beryllium*, Cadmium*, Chromium*, Cobalt, Copper*, Lead*, Mercury*, Nickel*, Silver*,
Vanadium, Zinc*

Volatile Organic Compounds:

Acetone

Extractable Organic Compounds:

Diethylphthalate*, Benzopyrene*, Diphenylamine, Butyl benzylphthalate*

LANDFILL WASTES

Phenol and Selected Anions:

Phenol*, Sulfide, Flouride

Metals:

Antimony*, Arsenic*, Barium, Beryllium*, Cadmium*, Chromium*, Copper*, Cobalt, Lead*, Mercury*,
Nickel*, Silver*, Vanadium, Zinc*

Volatile Organic Compounds:

Methylene Chloride*, Xylene, Ethylbenzene*, Toluene*, Carbon tetrachloride*, Butanone, Chloroform*,
Acetone

Extractable Organic Compounds:

Dichlorobenzene*, Naphthlene*, Flourene*, Fluoranthene*, Pyrene*, Diethylphthalate*, Dimethylphthalate*,
Dibenzofuran, Acenaphthene*, Chrysene*, Diethylphthalate*, Diphenylamine, Phenanthrene*,
Benzoanthracene*, Indenopyrene*, Benzopyrene*, Anthracene*, Dibutylphthalate*, Benzofluoranthene*,
Benzoperylene, Butyl benzylphthalate*, Dichloroaniline, Methylnaphthalene, Phenol*, Nitroaniline,
Bisphthalate*, Nitrobenzene*, Chlorophenylphenylether*

Pesticides:

BHC*, Heptachlor*, Aldrin*, Endosulfan*, Heptachlor epoxide*, DDE*, Dieldrin*, DDD*, Endrin*, Endrin
Aldehyde*, Endosulfan sulfate*, DDT*

LANDFILL SUBSURFACE SOIL

Phenol and Selected Anions:

Phenol*, Sulfide, Flouride

Metals:

Arsenic*, Barium, Beryllium*, Cadmium*, Chromium*, Cobalt, Copper*, Lead*, Mercury*, Nickel*, Silver*,
Vanadium, Zinc*

Volatile Organic Compounds:

Acetone, Xylene, Ethylbenzene*, Toluene*

Extractable Organic Compounds:

Diethylphthalate*, Benzopyrene*, Diphenylamine, Dichlorobenzene*, Butyl benzylphthalate*

GROUNDWATER

Phenol and Selected Anions:

Phenol*, Sulfide, Flouride

Metals:

Antimony*, Arsenic*, Barium, Beryllium*, Cadmium*, Chromium*, Cobalt, Copper*, Lead*, Mercury*,
Nickel*, Silver*, Thallium*, Vanadium, Zinc*

Volatile Organic Compounds:

Methylene chloride*, Dichloropropene*, Tetrahydrofuran, Acetone, Xylene, Benzene*, Dichloroethene*,

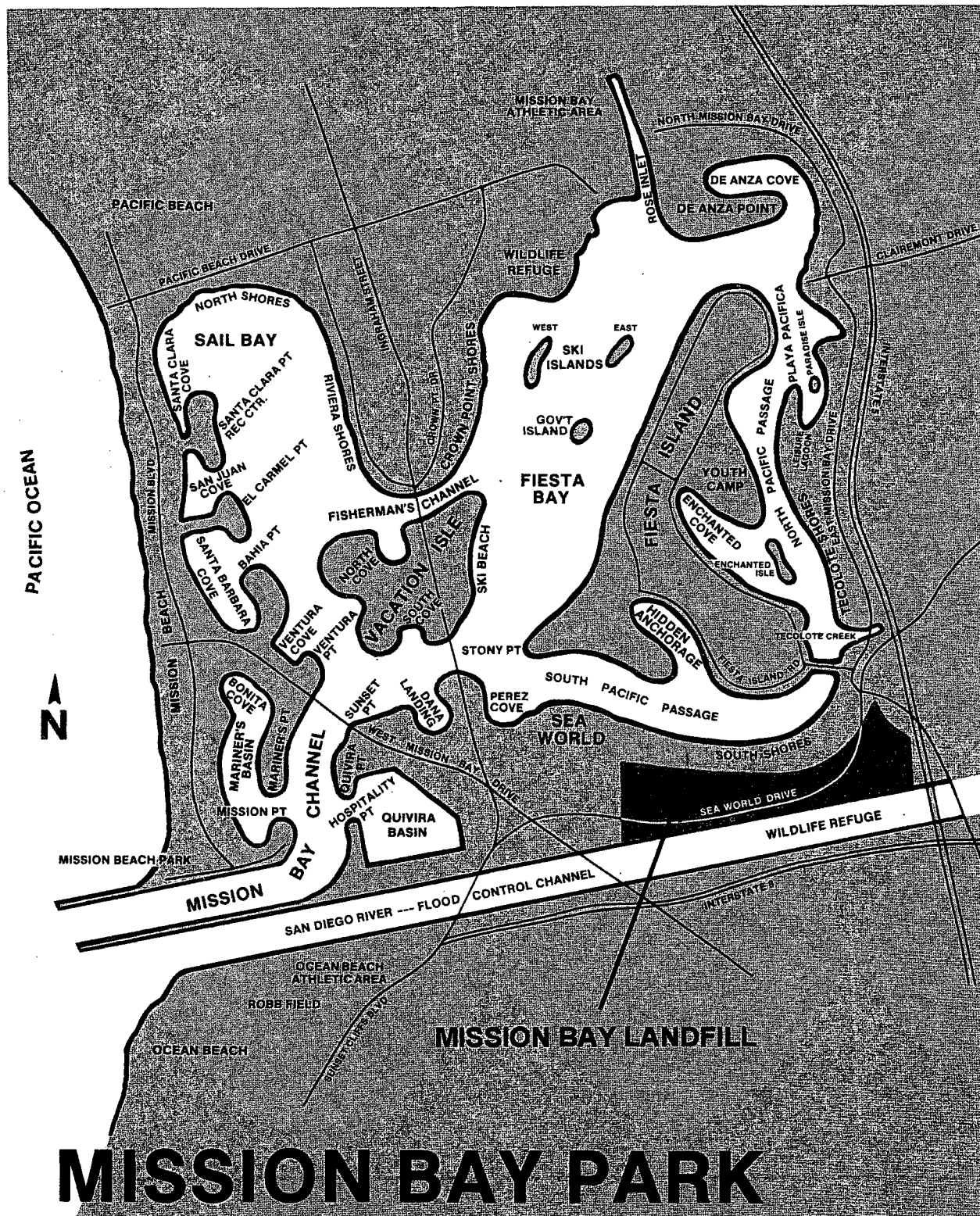
Toluene*, Chlorobenzene*, Ethylbenzene*, Chloroform*, Carbon tetrachloride*, Trichloroethene*

Extractable Organic Compounds:

Nitrosodimethylamine*, Phenol*, Dichlorobenzene*, Bisether*, Naphthalene*, Dioctylphthalate*,
Diphenylamine, Dimethylphenol*, Butyl benzylphthalate*, Methyl-naphthalene, Acenaphthene*, Fluorene*,
Dibenzofuran, Phenanthrene*, Diethylphthalate*, Dinitrotoluene*, Fluoranthene*, Pyrene*, Anthracene*

Pesticides:

BHC*, Heptachlor*, Aldrin*, Heptachlor epoxide*, Endosulfan*, DDD*, Endosulfan sulfate*, DDT*, DDE*,
Endrin*






MISSION BAY PARK

encl 4a

Mission Bay State Park

LEGEND

-  Proposed Developments
-  Park Boundaries
-  Existing Developments

- 1 SeaWorld Leasehold
(Expansion Now Proposed)
- 2 Quivera Basin
(Two Resort Hotels now Proposed)
- 3 Dana Inn
(Expanded-Sunset Point lost)
- 4 Bahia Resort Hotel
(Expansion Proposed)
- 5 Hilton Hotel
(Expansion Proposed)
- 6 DeAnza Point
(Two Resort Hotels now Proposed)

Pacific Ocean

San Diego River

Southern Wildlife Preserve

Famosa Slough

Kendall Frost Wildlife Reserve

Mission Bay

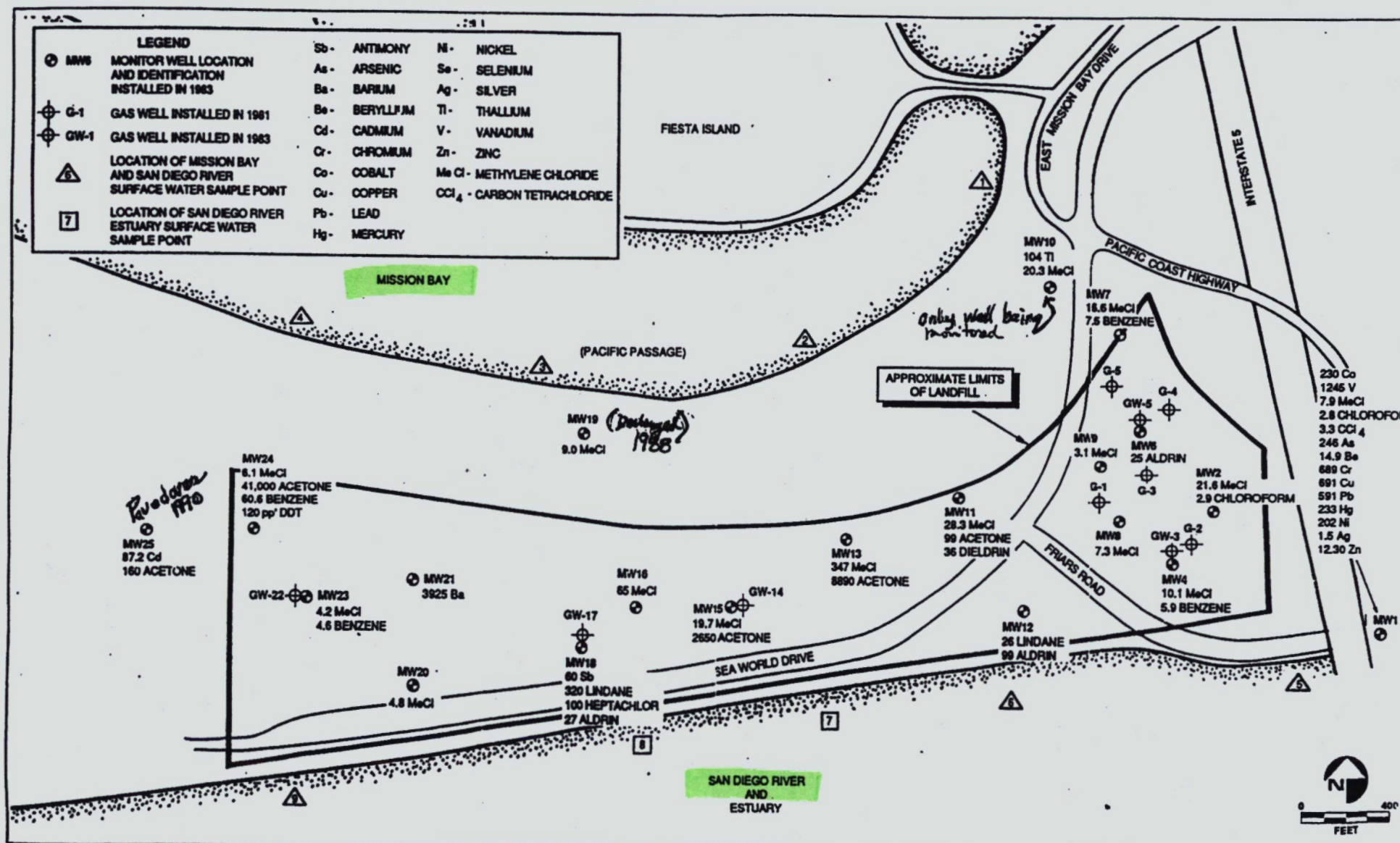
Fiesta Island

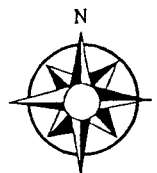
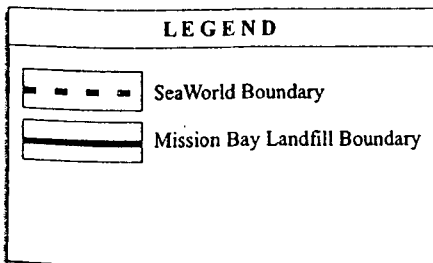
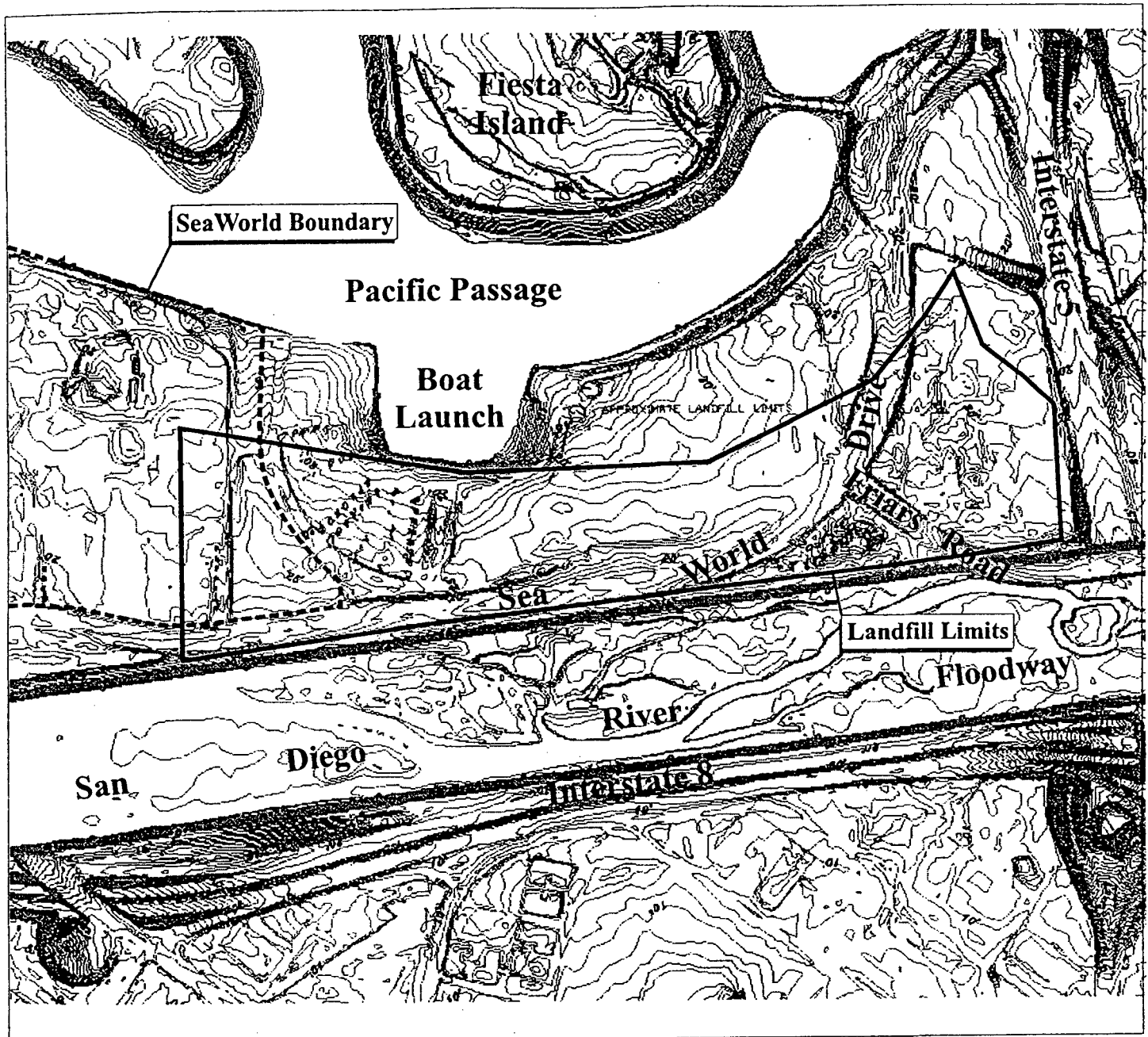
SeaWorld Leasehold

- Industrial Toxic Waste Dump



encl 4b





Not to Scale

Source: City of San Diego, Environmental Services Department, 5/25/2001

Approximate Limits of Mission Bay Landfill (Revised) _____ Figure 4.11-1

encl 4d

encl 40



MISSION BAY LANDFILL - AERIAL FLOWN 2/1999

MB-10 - 1983 well; MBW-1 - 1993 well; MBE-4 - 1996 well

MAP 3



California Regional Water Quality Control Board

San Diego Region



Gray Davis
Governor

W. H. Hickox
Secretary for
Environmental
Protection

Internet Address: <http://www.swrcb.ca.gov/rwqcb9/>
9174 Sky Park Court, Suite 100, San Diego, California 92123-4340
Phone (858) 467-2952 • FAX (858) 571-6972

February 6, 2003

To: Interested/Affected Parties

Dear Representatives:

RE: ADDENDUM NO. 3 TO ORDER 97-11 REVISING THE TITLE OF ORDER NO. 97-11 AND ADDENDA THERETO: "GENERAL WASTE DISCHARGE REQUIREMENTS FOR POST-CLOSURE MAINTENANCE OF INACTIVE NONHAZARDOUS WASTE LANDFILLS WITHIN THE SAN DIEGO REGION."

On February 5, 2003, this Regional Board adopted tentative Addendum No. 3 to Order No. 97-11. Tentative Addendum No. 3 to Order 97-11 revises the title of the waste discharge requirements (WDRs) for inactive landfill sites under Order 97-11. This change is being implemented as a result of our review of the range wastes reportedly discharged into the waste management units (landfills) currently enrolled in Order 97-11.

The revised title for Order 97-11 is as follows:

"General Waste Discharge Requirements for Post-Closure Maintenance of Inactive Landfills Containing Hazardous and Nonhazardous Wastes within the San Diego Region."

You are being sent a copy of Addendum No. 3 to Order 97-11 because you are either identified as a discharger responsible for a facility enrolled in Order 97-11, or the Regional Board has your name on an Interested Parties List for Order 97-11. If you are interested in reviewing the specific agenda materials for this action, please see the Regional Board agenda for February 5, 2003: Item No. 6 at the following address:

<http://www.swrcb.ca.gov/rwqcb9/rb9board/meetings.html>

Should you have any questions concerning the above matter, please contact Mr. John Odermatt at (858) 637-5595 or by email at oderj@rb9.swrcb.ca.gov.

Sincerely,

JOHN H. ROBERTUS

Executive Officer

JHR:jro

Enclosure: Addendum No. 3 to Order No. 97-11

Cc: Interested Parties List (see attached) with Enclosure

California Environmental Protection Agency

Recycled Paper

encl 5

ADDENDUM NO. 3 TO ORDER NO. 97-11

**GENERAL WASTE DISCHARGE REQUIREMENTS
FOR POST-CLOSURE MAINTENANCE OF
INACTIVE NONHAZARDOUS WASTE LANDFILLS
WITHIN THE SAN DIEGO REGION**

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

1. On April 9, 1997, this Regional Board adopted Order No. 97-11, *General Waste Discharge Requirements for Post-Closure Maintenance of Inactive Nonhazardous Waste Landfills within the San Diego Region*. Order No. 97-11 established landfill maintenance requirements and water quality monitoring for former landfills and burn sites that ceased operation prior to 1984.
2. Groundwater monitoring reports and pre-1984 historical data for landfills and burn sites covered under Order No. 97-11 indicate that wastes disposed into the facilities may have included significant quantities of wastes currently defined/characterized as "hazardous wastes", in addition to "designated", "nonhazardous" and or "inert" wastes.
3. The Regional Board has notified all dischargers and all known interested parties of its intent to add the term "hazardous" to the title of Order No. 97-11.
4. This action is exempt from the requirements of the California Environmental Quality Act (Public Resources Code 21000 et seq.) in accordance with Title 14, California Code of Regulations, Chapter 3, Section 15321.
5. The Regional Board, in a public meeting, heard and considered all comments pertaining to the proposed action.

IT IS HEREBY ORDERED,

1. Replace the title of Order No. 97-11 with the following: **"General Waste Discharge Requirements for Post-Closure Maintenance of Inactive Landfills Containing Hazardous and Nonhazardous Wastes within the San Diego Region."**

I, John H. Robertus, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Diego Region, on February 5, 2003.

Issued by:



JOHN H. ROBERTUS
Executive Officer



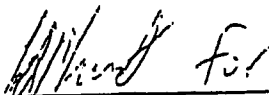
FLUOR DANIEL GTI

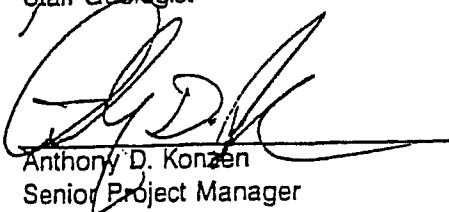
**ASSESSMENT REPORT
SEA WORLD LEASE EXPANSION
1720 SOUTH SHORES ROAD
SAN DIEGO, CALIFORNIA
HMMD CASE NO. H21142
June 9, 1997**

Fluor Daniel GTI Project 023400221

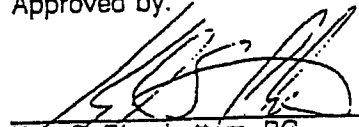
Prepared for:
Mr. Kevin Carr
Sea World Of California
1720 South Shores Road
San Diego, California 92109-7995

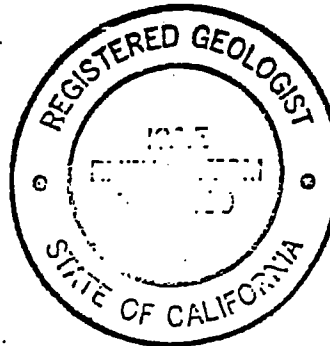
Fluor Daniel GTI, Inc.
Submitted by:


Fred Essig
Staff Geologist


Anthony D. Konzen
Senior Project Manager

Fluor Daniel GTI, Inc.
Approved by:


Kyle S. Rheubottom, RG
Operations Manager



023400221
0221R-02.20/Sea World/LE/#1

encl 6

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2. Site Plan
3. Groundwater Gradient Map
4. Hydrocarbon Concentrations in Soil
5. Acetone Concentrations in Soil
6. Cross Sections A-A' and B-B'
7. 1,1,1-Trichloroethane Concentrations in Groundwater

Tables

1. Monitoring Data, Sampled January 20, 1997, Sea World, 1720 South Shores Drive, San Diego, California
2. Soil Analytical Results, Sampled December 20 and 23, 1996 and January 9, 1997, Sea World, 1720 South Shores Drive, San Diego, California
3. Groundwater Analytical Results, Sampled January 20, 1997 and April 29, 1997, Sea World, 1720 South Shores Drive, San Diego, California

Appendices

1. Boring Logs
2. Boring Permit
3. Non-hazardous Waste Data Forms
4. Soil Sampling QA/QC Procedures, Laboratory Analytical Reports, and Chain-of-Custodies



1.0 INTRODUCTION

1.1 Site Identification

Company Name: Sea World of California

Site Address: 1720 South Shores Road
San Diego, California 92109

Assessors Parcel No.: 435-480-15

HMMD Case No.: H00905

Property Owner: City of San Diego Real Estate Assets
1200 Third Avenue
San Diego, California 92101
(619) 236-6985
Attn: Linda Fierro

Contact Person: Mr. Kevin Carr
1720 South Shores Road
San Diego, California 92109
(619) 226-3934

Responsible Party: Sea World of California
1720 South Shores Road.
San Diego, California 92109

1.2 Purpose of Work

The purpose of this investigation was to summarize past and present site use, and analyze soil and groundwater in the subsurface for the presence of gasoline hydrocarbons, volatile organic and semi-volatile organic compounds, and CAM metals.

The investigation centered on a parcel of City-owned land immediately east of the Sea World Park Boundary. The parcel is within the inactive Mission Bay Landfill and is currently under a landfill monitoring program overseen by the Regional Water Quality Control Board (RWQCB) (Figures 1 and 2). Wells MBW-2 and 3 shown on Figure 2 were installed by the City of San Diego and are included in the RWQCB monitoring program.

1.3 Background

Site activities performed to date are summarized below.

- The City of San Diego used the area as an unrestricted Class 1 landfill from 1952 to 1959.
- Between 1959 and 1962, 5 to 20 feet of hydraulic fill was placed over the landfill.
- Woodward-Clyde Consultants (WWC) submitted a summary of a comprehensive investigation into the extent and hazardous waste content of the City of San Diego's Mission Bay Landfill. (WWC, 1983).
- California RWQCB Order No. 85-78 (September 16, 1985) established periodic sampling of groundwater within the landfill plus surface water and sediment sampling of Mission Bay and the San Diego River.
- In 1996 Sea World planned to lease the parcel immediately to the east of the park.
- In December 1996 and January 1997, Fluor Daniel GTI, Inc. (Fluor Daniel GTI) conducted Phase I and Phase II investigations on the undeveloped parcel located east of the Sea World property boundary. On April 29, 1997, an additional round of groundwater samples was collected from wells LE-1 through LE-6 for metals analyses.

1.4 Scope of Services

Fluor Daniel GTI performed or subcontracted the following work in accordance with the Cost Estimate For Phase I and II Site for Sea World Expansion - East (Fluor Daniel GTI, 1996).

Phase I Investigation

- Compiled a Phase I assessment report in general accordance with the instructions from Sea World dated April 22, 1996. The assessment data was compiled from the following sources; regulatory file reviews, personal interviews, site reconnaissance, data base reviews, and review of photographic archives.



Phase II Investigation

- Obtained permits to drill and install six groundwater monitoring wells.
- Obtained an Underground Service Alert number and met with utility companies prior to drilling.
- Drilled, logged, sampled, and installed six wells ranging in depth from 33 to 35 feet below grade (Figure 2).
- Collected soil samples at approximate 5-foot intervals for lithologic evaluation and laboratory analysis.
- Purged and sampled the 6 monitoring wells (2 events).
- Coordinated analysis of 12 soil samples and 6 groundwater samples.
- Prepared a "30-day" drilling report as required by the San Diego County Site Assessment and Mitigation Division (SAMD).
- Prepared an assessment report summarizing Phase I research and this most recent landfill-site assessment.

2.0 GEOLOGY AND HYDROGEOLOGY

2.1 Geology

As mapped by Kennedy and Peterson (1975), the site is built upon land reclaimed by hydraulic fill which is apparently underlain by formations included in the Eocene Poway and La Jolla Groups. The site is situated on the south side of Mission Bay essentially at sea level (Figure 1). The study area has little relief except that dictated by structures in the vicinity.

2.2 Site Geologic Description/Soil Types

As observed from the borings drilled by Fluor Daniel GTI on December 20 and 23, 1996 and on January 9, 1997, the site is underlain by hydraulic fill that extends to the maximum depths explored. The hydraulic fill is characterized by randomly distributed sand and sand/silt mixtures with trace amounts of gravel. Boring logs from the recent drilling investigation are presented in Appendix 1.



The November 17, 1983 WWC report described encountering various types of landfill waste (i.e., wood, paper, glass, etc.) during 1980 test pit excavation. Landfill debris was not encountered during December 1996 through January 1997 drilling investigation, indicating that the borings were not within the landfill limits.

2.3 Hydrogeology

The site lies within the Mission San Diego Hydrologic Subarea (HSA 7.11) of the Lower San Diego Hydrologic Area (HA 7.10) of the San Diego Hydrologic Unit (HU 7.00). Because the site is west of Interstate 5, there are no beneficial uses for groundwater (RWQCB, San Diego Region Basin Planning Area).

Surface drainage in the vicinity of the site is toward Mission Bay immediately to the north. The San Diego River floodway is located approximately one-half mile to the south. There are no permanent streams in the area surrounding the site (Figure 1).

Groundwater depths gauged on January 20, 1997 ranged from 11.68 to 21.32 feet below grade. Because of significant tidal influence, groundwater gradient and flow were not determined. Groundwater elevations are presented in Figure 3 and Table 1.

The tidal influence on groundwater elevation was measured in well LE-3 on January 9, 1997. The groundwater elevation in LE-3 declined 4.2 feet between 8:50 AM and 3:30 PM. Because of this tidal influence and the likelihood of lateral permeability variations due to the random nature of artificial fill emplacement, a groundwater gradient map was not prepared.

2.4 Summary of the Phase I Report

The WWC *Site Assessment Report* summarizes the findings of a comprehensive investigation into the extent and hazardous waste content of the City of San Diego's Mission Bay Landfill. According to the report, the landfill occupies approximately 115 acres in the southeast corner of Mission Bay. The lease expansion is located above the western extent of the landfill. The City of San Diego used the area as an unrestricted Class I landfill from 1952 to 1959. The landfill received up to 25,000 cubic yards of municipal and commercial waste per month. Of most concern, the landfill reportedly received unknown amounts of hazardous industrial wastes including: carbon tetrachloride, methyl-ethyl ketone, toluene, chlorinated cleaning solvents, paint and oil waste, sulfuric acid, hydrofluoric



☆ acid, chromic acid, hydrochloric acid, cyanide, zinc chromate, and cadmium. Between 1959 and 1962, 5 to 20 feet of hydraulic fill was placed over the landfill. The scope of the site assessment investigation performed by WWC included reviewing landfill operation documents, photographs and reports, interviewing landfill eyewitnesses, conducting geophysical and soil gas surveys, and drilling and sampling soil borings and groundwater monitoring wells. The report had a number of conclusions: 1) As many as 130 metallic drums per acre were dumped in the landfill. Most of these drums would have corroded and released their contents within ten years. 2) Elevated concentrations of arsenic, cadmium, copper, lead, mercury, and zinc were observed in landfill waste samples. The metals likely exist as metallic sulfides which have limited mobility. 3) Hydrocarbon pollutant concentrations were generally low. Detectable acetone concentrations were on the order of 1 parts per million (ppm). Naphthalene and phenanthrene were detected at concentrations up to 13 ppm and 6.2 ppm, respectively. 4) Carbon tetrachloride, cyanide, and polychlorinated biphenyls (PCBs) were not detected in soil samples. 5) Groundwater samples contained elevated concentrations of arsenic, copper, nickel, lead, and zinc. Acetone was detected in groundwater at concentrations up to 41,000 parts per billion (ppb). Eleven other volatile organic compounds were found at concentrations up to 50 ppb. Twenty extractable organic compounds were found at concentrations up to 5 ppb.

3.0 HEALTH AND SAFETY

A site-specific health and safety plan was prepared prior to drilling. An "Agreement and Acknowledgment" statement was signed by on-site personnel indicating that the health and safety plan had been read and understood. Hydrogen sulfide and methane gas were identified site-specific hazards and air monitoring was performed continuously throughout the well drilling and installation procedure.

4.0 PERMITTING

A boring permit for six monitoring wells was acquired from the San Diego County HMMD prior to drilling (Appendix 2).

5.0 PRELIMINARY DRILLING ASSESSMENT

5.1 Drilling

On December 20 and 23, 1996, wells LE-1, LE-2, and LE-3 were drilled and installed in the lease expansion area (Figure 2). During the drilling of LE-4, on December 23, hydrogen sulfide gas was detected at concentrations as high as 9 ppm and methane was detected at a maximum of 1,000 ppm. Drilling was immediately halted and boring LE-4 was backfilled. On January 9, 1997 the drilling was again mobilized following additional study and preparation for the hydrogen sulfide and methane hazard. Wells LE-5 and LE-6 were installed and boring LE-4 was re-drilled and converted to a monitoring well. To minimize exposure to methane and hydrogen sulfide gasses, work was conducted up-wind and fans were used to ventilate the work area.

The wells were drilled with a CME-75 drill rig using 8 and 9-inch diameter hollow-stem augers.

5.2 Soil and Groundwater Disposal

On May 1, 1997, seventeen drums of soil cuttings were disposed of at the waste disposal facility in McKittrick, California. Twelve drums of auger rinsate and well purge water were disposed of at DeMenno/Kerdoon in Compton, California on May 5, 1997. The soil and water were transported under non-hazardous waste manifests (Appendix 3).

Of the drums disposed of, nine soil and one water were generated during a previous investigation at the Sea World Wild Arctic Exhibit.

5.3 Soil Sampling and Analyses

Samples were collected at approximate 5-foot intervals for lithologic description and hydrocarbon analyses. Samples were collected in general accordance with the Quality Assurance/Quality Control procedures listed in Appendix 4.

Two soil samples were selected from each of the six borings for analysis. All soil samples were analyzed for hydrocarbon components using the EPA Method 8015 hydrocarbon screen. Additionally, all soil samples from borings LE-1 through LE-4 were analyzed for volatile organic



compounds by EPA method 8020 and one soil sample from each of the six borings was analyzed for volatile and semi-volatile organic compounds using EPA methods 8240, and 8270, respectively. Analyses of soil samples were performed by Del Mar Analytical, a State-certified laboratory. After further discussions with Sea World in April 1997, one sample from each boring was additionally analyzed for CAM metals.

5.4 Groundwater Sampling and Analysis

Wild Arctic well WA-3 was gauged and Lease Expansion wells LE-1 through LE-6 were gauged, purged, and sampled on January 20, 1997. Wells LE-1 through LE-6 were gauged, purged and sampled again on April 29, 1997.

One sample was submitted from each well for analysis. The samples collected on January 20 were analyzed for organic lead, total lead, volatile organics, and semi-volatile organics using the California DHS Method, and EPA Methods 7421, 8240, and 8270, respectively. The samples collected on April 29 were analyzed for CAM metals.

Chemical analyses of the groundwater samples were performed by Del Mar Analytical. Samples were collected in general accordance with the Quality Assurance/Quality Control procedures listed in Appendix 4. To reduce interference from soil particles in suspension, groundwater samples collected on April 29 were filtered and acidified at the laboratory prior to metals analyses.

6.0 FINDINGS

6.1 Soil Analytical Results

Twelve soil samples were analyzed for hydrocarbon components using the EPA Method 8015 hydrocarbon screen. Samples from wells LE-1 through LE-5 were screened in the C_6 to C_{44} range (gas standard and diesel standard) and analyzed for volatile organic (BTEX) compounds using EPA method 8020. Samples from wells LE-5 and LE-6 were screened against the C_{10} to C_{40} diesel fuel standard (Figure 4). Soil analytical data are summarized in Table 2. Laboratory reports are in Appendix 4.



Hydrocarbons within the C_{22} through C_{44} range were detected in soil from well LE-1 at 10 feet below grade (79 milligrams per kilogram, mg/kg). Hydrocarbons within the C_{10} through C_{44} range were detected in both samples from well LE-4 (200 mg/kg at 10 feet, 380 mg/kg at 15 feet below grade). The hydrocarbons sources for the C_{10} to C_{20} range are likely diesel-weight fuels and solvents; source materials for the C_{20} to C_{44} range include heavier oils such as hydraulic, motor, and natural oils.

One sample from each of the six borings was analyzed for volatile organics, semi-volatile organics, and metals using EPA methods 8240, 8270, and various EPA 6000 and 7000 methods. Acetone was detected 15 feet below grade in wells LE-3, LE-4, LE-5, and LE-6 at 26 micrograms per kilogram ($\mu\text{g}/\text{kg}$), 220 $\mu\text{g}/\text{kg}$, 21 $\mu\text{g}/\text{kg}$, and 14 $\mu\text{g}/\text{kg}$, respectively (Figures 5 and 6). In well LE-4, 2-butanone (MEK) was detected 15 feet below grade at 36 $\mu\text{g}/\text{kg}$. Acetone and 2-butanone are solvents typically used in the aerospace industries, their detection most likely the result of aerospace manufacturing-waste disposal in the former landfill. These same constituents were detected at higher concentrations during the 1983 WWC investigation. Acetone and 2-butanone are not listed as constituents of concern in the Basin Plan guidelines.

PRG		ppb	
tap	H ₂ O	soil	
Acetone	610	1600	
MEK	1900	7300	

Generally, metals analyses showed detectable concentrations of arsenic, barium, total chromium, cadmium, cobalt, copper, lead, molybdenum, nickel, vanadium and zinc. Sample LE-2-10 had a chromium concentration of 79 mg/kg which exceeded the soluble threshold limit concentration (STLC) by more than 10 times. However, the remaining samples and the statistical mean were below the 10 times limit. None of the metals exceeded the total threshold limit concentration (TTLC) values.

6.2 Groundwater Analytical Results

No total lead or organic lead were found in any of the groundwater samples. Groundwater analytical data is summarized in Table 3, laboratory reports are in Appendix 4.

On January 20, 1997, detectable 1,1,1-trichloroethane concentrations ranged from 2.4 micrograms per liter ($\mu\text{g}/\text{L}$) in wells LE-4 and LE-6 to 7.2 $\mu\text{g}/\text{L}$ in LE-2. Only well LE-3 contained nondetectable 1,1,1-trichloroethane. The contaminant appears to be widely dispersed in a relatively uniform concentration, consistent with dated landfill disposal of barrels in a corrosive environment. 1,1,1-Trichloroethane is widely used as a solvent in the aerospace industry. Figure 7 shows the distribution of 1,1,1-trichloroethane in the "LE" series wells.



The groundwater Maximum Contaminant Limit (MCL) concentration in the Basin Plan for 1,1,1-trichloroethane is 200 $\mu\text{g/L}$. During this investigation, 1,1,1-trichloroethane concentrations did not exceed MCL limits (Table 3).

Generally, metals analyses showed detectable concentrations of barium, selenium, silver, and zinc (Table 3). A majority of the metals concentrations were below detection limits. Dissolved selenium, silver, and zinc concentrations exceeded Basin Plan oceanwater quality goals (RWQCB, 1994). However, applicable groundwater MCLs for these metals are unlisted in the Basin Plan.

7.0 SUMMARY

- In December 1996 and January 1997, wells LE-1 through LE-6 were drilled and installed. Landfill debris was not encountered during drilling.
- The site lies within the Mission San Diego Hydrologic Subarea (HSA 7.11) of the Lower San Diego Hydrologic Area (HA 7.10) of the San Diego Hydrologic Unit (HU 7.00). Based on the January 20, 1997 gauging, groundwater depths at the site were between 11.68 and 21.32 feet below grade. Due to tidal fluctuations, groundwater gradient and flow direction were not determined.
- Hydrocarbons within the C_{22} through C_{44} range were detected in soil from well LE-1 at 10 feet below grade (79 mg/kg). Hydrocarbons within the C_{10} through C_{44} range were detected in both samples from well LE-4 (200 mg/kg at 10 feet, 380 mg/kg at 15 feet below grade). The hydrocarbons sources for the C_{10} to C_{20} range are likely diesel-weight fuels and solvents, source materials for the C_{20} to C_{44} range include heavier oils such as hydraulic, motor, and natural oils.
- Acetone in soil was detected 15 feet below grade in wells LE-3, LE-4, LE-5, and LE-6 at 26 $\mu\text{g/kg}$, 220 $\mu\text{g/kg}$, 21 $\mu\text{g/kg}$, and 14 $\mu\text{g/kg}$, respectively. In well LE-4, 2-butanone (MEK) was detected 15 feet below grade at 36 $\mu\text{g/kg}$. Acetone and 2-butanone are solvents typically used in the aerospace industries, their detection most likely the result of aerospace manufacturing-waste disposal in the former landfill. Metals analyses generally showed detectable arsenic, barium, total chromium, cadmium, cobalt, copper, lead, molybdenum, nickel, vanadium and zinc. Concentrations were below levels discussed in the 1983 WWC report, and below TTLC levels. Some of the metals concentrations likely represent natural background concentrations.

- 1,1,1-trichloroethane was found in groundwater samples from every well except LE-3 at concentrations from 2.4 $\mu\text{g/L}$ in well LE-4 and LE-6 to 7.2 $\mu\text{g/L}$ in LE-2. The contaminant appears to be widely dispersed in a relatively uniform concentration, consistent with dated landfill disposal of barrels in a corrosive environment. 1,1,1-Trichloroethane is widely used as a solvent in the aerospace industry. The Basin Plan MCL concentration for 1,1,1-trichloroethane is 200 $\mu\text{g/L}$. During this investigation 1,1,1-trichloroethane concentrations did not exceed MCL limits. No other organic compounds listed in the Basin Plan as contaminants of concern were detected in this investigation.
- Detectable concentrations of barium, silver, selenium and zinc were measured in groundwater samples. Applicable Basin Plan groundwater quality goals are not listed. Chromium, cobalt, copper and other metals detected in the WWC wells were not detected in the "LE" series wells.

8.0 REFERENCES

California Water Resources Control Board and California Regional Water Quality Control Board, San Diego Region (9), June 1994, *Comprehensive Water Quality Control Plan for the San Diego Basin*.

California Water Regional Water Quality Control Board, San Diego Region, 1990, Resolution No. 90-55, *A Resolution Adopting Amendments to the Comprehensive Water Quality Control Plan for the San Diego Region*.

Fluor Daniel GTI, Inc., 1996, *Cost Estimate For Phase I and II Site for Sea World Expansion - East*, May 7.

Kennedy and Peterson, 1975, *Geology of the San Diego Metropolitan Area, California*, California Division of Mines and Geology, Bulletin 200.

Woodward-Clyde Consultants, 1983, *Site Assessment Report*, November 17.



TABLE 1
Monitoring Data
Sampled January 20, 1997
Sea World, 1720 South Shores Drive, San Diego, California

Well ID	DTW	TOC Surveyed Wellhead Elevation	Elevation of Water
WA-1	NA	22.22	
WA-2	NA	20.39	
WA-3	15.35	19.23	3.88
LE-1	21.32	24.36	3.04
LE-2	11.68	15.11	3.43
LE-3	14.85	19.99	5.14
LE-4	15.96	20.28	4.32
LE-5	15.37	21.17	5.80
LE-6	16.84	19.96	3.12

Notes:

- 1) All depths are reported in feet
- 2) DTW = depth to water
- 3) TOC = top of casing
- 4) NA = not available

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TABLE 2
Soil Analytical Results
 Sampled December 20 and 23, 1996 and January 9, 1997
 Sea World, 1720 South Shores Drive, San Diego, California

Sample ID	Hydrocarbon Range	TPH Screen	TPH _g	B	T	E	X
LE-1-10	C ₂₂ - C ₄₄	79	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-1-15	NA	<5.0	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-2-5	NA	<5.0	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-2-10	NA	<5.0	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-3-10	NA	<5.0	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-3-15	NA	<5.0	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-4-10	C ₁₀ - C ₄₄	200	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-4-15	C ₁₀ - C ₄₄	380	<1.0	<0.0050	<0.0050	<0.0050	<0.015
LE-5-10	NA	<5.0	--	--	--	--	--
LE-5-15	NA	<5.0	--	--	--	--	--
LE-6-10	NA	<5.0	--	--	--	--	--
LE-6-15	NA	<5.0	--	--	--	--	--

Notes:

- 1) All results reported in mg/kg
- 2) TPH = total petroleum hydrocarbons; analyzed using EPA 3550/CA DHS Modified 8015
- 3) TPH_g = total petroleum hydrocarbons as gasoline; analyzed using EPA 5030/CA DHS Modified 8015/8020
- 4) B = benzene, T = toluene, E = ethylbenzene, X = xylenes; analyzed using EPA 5030/CA DHS Modified 8015/8020
- 5) < number = analyte below reported detection limit
- 6) NA = not applicable
- 7) -- = not analyzed



TABLE 3
Groundwater Analytical Results
 Sampled January 20, 1997 and April 29, 1997
 Sea World, 1720 South Shores Drive, San Diego, California

Well ID	1,1,1-Trichloroethane	Barium	Selenium	Silver	Zinc
LE-1	6.5	180	<10	85	<50
LE-2	7.2	<50	27	<50	74
LE-3	<2.0	70	33	<50	<50
LE-4	2.4	3,700	26	<50	<50
LE-5	4.8	<50	19	<50	<50
LE-6	2.4	310	45	<50	<50
Basin Plan Water Quality Goal	200 ²	NL	15 ³	0.7 ³	20 ³

Notes:

- 1) All results reported in µg/L
- 2) Basin Plan Groundwater Primary Maximum Contaminant Level, RWQCB, Region IX, 6/94
- 3) Basin Plan Ocean Water Quality Goal, RWQCB, Region IX, 6/94
- 4) NL = Maximum Contaminant Level not listed in Basin Plan
- 5) 1,1,1-trichloroethane by EPA Method 8240, barium, silver, and zinc by EPA Method 200.7, selenium by EPA Method 200.9

